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Soil Conservation Service
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To: Participants and Committee Members of the National Technical Work-Planning Conference of the Cooperative Soil Survey

From: R. D. Hockensmith, Director, Soil Survey Operations

Subject: Report of the 1958 National Work-Planning Conference of the Cooperative Soil Survey

Transmitted herewith is the report of the 1958 National Technical Work-Planning Conference of the Cooperative Soil Survey, which includes abstracts of talks by Charles E. Kellogg, Marlin G. Cline, H. P. Ulrich, H. B. Vanderford, and LeMoyne Wilson, and reports of the committees.

Information on those items in these reports on which agreements were reached will be released through official channels for widespread use. Other items need further study. Thus, these committee reports should not be given widespread distribution. They have no official status in their present form.

Sufficient copies are being sent to the office of each State Conservationist for distribution to the appropriate State Experiment Station Soil Survey leaders and to soil survey representatives of other agencies that are engaged in soil survey work in the State. In addition sufficient copies are being sent for use by the State soil scientist, assistant State soil scientist and GS-11 soil survey specialists. The State soil scientist may wish to circulate one copy of this report among the GS-9 soil scientists, but in doing so it should be made clear that the information, ideas, and data in these committee reports simply represent trends in thinking and progress of work. Thus, they do not necessarily represent official views although many of the methods ultimately may be adopted officially.

The committee reports are: Soil Survey Interpretations (General) Including Capability Classification and Assembling Basic Data; Soil Moisture; Improving Soil Survey Procedures; Soil Horizon Nomenclature; Use of Published Soil Maps (Including Report on Field Trial of their Use in Farm Planning); Climate in Relation to Soil Classification and Soil Use; Soil Surveys for Range Uses; Soil Surveys for Forestry Uses; Relation of Low Family Groupings to Capability Units; Small Scale Maps; Criteria for Series, Types and Phases; Organic Soils; Mapping Eroded Soils; Grades of Soil Structure; and Engineering Applications.

R. D. Hockensmith

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Abstract of Opening Remarks by Dr. Charles E. Kellogg

Mr. Donald A. Williams, Administrator of the Service, had planned to be with us; unhappily he had to stay in Washington for the appropriation hearings in the Senate.

The budget outlook for next year does not, at this time, suggest any increased Federal funds for soil survey work. In fact, because of increases in costs, we may have to do with slightly less facilities. But, of course, we shall not know definitely until after the Congress concludes its study of the Department's supply bill. The total Federal funds now used in the soil survey work lie between 9 and 10 million dollars.

During the past few years I judge that the State allocations in soil survey work have increased some, although I have no precise records. About 5 years ago my staff estimated the total State funds at around $750,000. I suspect the outlook for the next fiscal year is higher than that, I should say at least $800,000, and perhaps more than $1,000,000; but I do not know definitely.

We all realize, however, that many State colleges and universities make other important contributions to the cooperative work through the help that their staffs give on soil survey interpretations and through researches carried out by the staffs and by graduate students. My own impression is that effective cooperation in the soil survey work between the Service and the State experiment stations has increased significantly during the past year.

Progress, nation-wide, has stepped up markedly in field mapping, although we still have some serious problems in completion of soil survey handbooks and reports. Soil mapping by soil scientists in the Service increased 14.7 percent in the calendar year 1957 over 1956, standard soil mapping was up 60 percent. In 1957 we had about 26.8 million acres reported as standard soil surveys and about 12.4 million as soil conservation surveys.

These increases resulted from several interrelated factors.

(1) We have had a substantial increase in the number of standard legends.
(2) We have had an increased number of closed legends even among the soil conservation surveys.
(3) With increases in progressive mapping, the rates are higher.
(4) We have already had much more orderly scheduling and planning of the several parts of the soil survey job.
(5) Line officers in the Service, especially area conservationists, have been giving more careful attention to the soil survey schedules in their areas and to the use of time of the soil scientists. Somewhat more than one-half of the official time of the soil scientists in the field was devoted to soil survey work.

As a national average, standard soil mapping was carried out at the rate of 55.4 acres per man hour and soil conservation surveys at the rate of 37.7. Now of course most of these soil conservation surveys were of scattered farms where progress is naturally slower. Then too, a part of the reported standard soil survey has come from the conversion of soil conservation surveys requiring less than full field revision. If we can gain in the relative proportion of progressive standard surveys, we can expect improvements in both rate and quality.

Soil survey interpretation has been emphasized. Last year we discussed in some detail the progress made on a revised statement of assumptions, criteria, and definitions of the categories of the capability groupings. This statement has been reviewed by all the States and is getting close to a final draft for sending out for field use. Not many changes will be required, but probably some in order to achieve reasonable uniformity among States. I am sure that everyone will see opportunities for further improvement. I doubt that it will be practicable to make any substantial improvements until we have considerably more data on estimated yields under alternative systems of management by specific kinds of soil.

Perhaps the most important emphasis now should be placed upon the preparation of soil handbooks, which are really expanded descriptive legends and are, when well prepared, a most important part of the technical guide in districts. The handbooks become first drafts of soil survey reports and through their use other soil scientists and other specialists in the Service and in cooperating agencies have the best opportunity to criticize them and help to improve them. Next after the descriptive legends a table of yield estimates for the adapted crops under alternative systems of management is of the greatest importance. Once that is developed in satisfactory form many of the other groupings that are needed can be made rather easily.

We have continued to make excellent progress with the engineering interpretations and more will be said about that at our conference.

Our soil survey publications were delayed for a time in the Government Printing Office but just now many new releases are coming and others can be expected soon.

We are short, however, of adequate soil survey reports. Back of that is a shortage of descriptive legends and handbooks. The shortage of manuscripts could become critical since we are staffed to handle about 50 a year.

The use of soil surveys is expanding rapidly as people become more acquainted with them. Among these uses is a growing interest in their applications to the problems of suburban development. I think we can expect a good deal of interest in the further use of surveys in the ways that are being used in Fairfax County, Virginia. Before this application can go ahead smoothly in urban and suburban areas, I feel that it will be important to follow the example set and to have a soil scientist on the staff of the local community, either city or county government.

There continues to be a great interest in our soil surveys for use in land appraisal for rural tax assessment. Certainly we should favor such a use where

the maps are sufficiently accurate for the purpose; but it is highly important that the people using them understand them thoroughly. Otherwise they are bound to make serious mistakes that may be blamed on the maps when the difficulty was with their interpretations.

Soil correlation work is developing well but not proceeding as rapidly as we should like to see. This is probably a matter of further training and improved soil descriptions and descriptive legends for adequate field correlation. And with them both the intermediate and final correlations can be handled more expeditiously. Of course, we can expect some additional problems in correlation in the West and in parts of the Great Plains where surveys are being made in areas that have not been previously studied.

The laboratory facilities have been expanded somewhat but still are very tight in relation to our needs in correlation. The work is progressing on expanding the quarters for the laboratory at Riverside and they should be able to handle somewhat more work next fiscal year.

Several lines of investigations are going forward. Dr. Ruhe is starting a study of the arroyos of the southwest in order to seek criteria for distinguishing between those that have been stimulated by land use and those which are a normal concomitant of natural processes of landscape change. Dr. Kubota has found an interesting relationship between cobalt deficiency in plants and the extent to which the soils have the features of Ground-Water Podzols. He also has excellent leads on the relationship between molybdenum toxicity in some of the western areas and natural drainage and other features of the soils. Dr. Alexander is completing the work on a new publication on laterite and, of course, he has been continuing his research for the Atomic Energy Commission. Other special studies include preliminary investigation of cat clays along the Atlantic and Gulf coasts and studies of the correlation of climatic data with recorded variability in crop yields. Of course, there are other studies under way besides these.

For overseas assignments we continue to get many requests for some of our more skilled soil scientists. Considering the needs of our going program, it is very difficult to spare our top men for more than short periods where the experience gained has a direct bearing on our program at home.

Training continues to be a problem. I have heard only excellent reports of the training schedules conducted by the principal soil correlators on the elementary principles of soil correlation. We still lack any follow-through for further training in that field except guided personal study and especially graduate work.

We all have an obligation to set examples of good professional approach to soil work. This still remains a first prerequisite for consistent improvement. Some of our soil scientists do not realize this fully and they need encouragement in their professional reading and professional writing.

Work-Planning conferences. If I recall correctly, this conference is the 23rd in a series dating back to 1935. During the 30's and 40's the major activity of this conference was the development of standards for uniform definitions and

description of all the various soil characteristics important to soil classification. I suppose that at least one-half of the material in the Soil Survey Manual originated in the first instance from reports of committees of this Conference. About 1942 the State land-grant colleges and universities organized themselves into 4 regional groups in order to facilitate cooperative regional research. It was suggested that where these groups had soil survey subcommittees of the soil research committee a representative be authorized to attend this national soil survey conference. Before that the soil survey specialists in the colleges had opportunities to review committee reports prior to the adoption of recommendations.

Following the reorganization of the Soil Survey in the Soil Conservation Service in 1952 it was agreed that the colleges and the Service would also have four regional soil survey work-planning conferences. Both the national conference and the regional conferences were set up to deal with technical and scientific questions. At the same time, it is realized that there is always a possibility of some overlap between technical questions and administrative questions. The State experiment stations have commonly had a State experiment station director sit with their technical committees. I realize that this has not always been done but the principle is sound. For the same reasons we have asked a State conservationist or someone reporting to the Administrator of the Service to sit in the conferences.

In certain respects the regional conferences have not been entirely satisfactory because the 4-way group of the colleges does not coincide with the 5-way group of the States for correlation. Then too, questions have been raised about the need of having these conferences every year. Thus, we may not need to have this National Conference each year.

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Report of the Southern Regional Soil Survey Conference

H. B. Vanderford

General Remarks

The Southern Regional Soil Survey Work-Planning Conference met in Fayetteville, Arkansas, October 7-11, 1957. There was a good representation from the Soil Conservation Service and several of the States. We received a warm welcome from the President of the University and the Dean of Agriculture.

Mr. Hollis Williams, State Conservationist for Arkansas, gave an interesting report on the land and water resources of Arkansas. Among many things which he reported he stated that the State of Arkansas was admitted to the Union in 1836 and he further stated that it was still in the Union.

One of the highlights of the Southern Conference was a report by an engineer, Mr. Helmer from Oklahoma. Mr. Helmer reported that soil maps and soil classification were very useful to the highway construction engineer in the location of highways and the soil materials used for construction of highway beds. He stated that several years ago Highway #70 was located and constructed across Choctaw County, Oklahoma. This particular highway crossed about 32 miles of fine clay soils. Because of the swelling of these clays, over two feet of fill had to be placed over these soils. This increased the cost of the construction of the highway considerably over these 32 miles of the county. He estimated that the additional cost for the construction of this highway over the clay soils could have been saved by the use of the soil maps. A soil survey map which was published later showed that the highway could have moved one mile and the heavy soils would have been missed completely. He further stated that if the soil survey map had been available and used the Highway Department could have saved the taxpayers about $600,000.

After making that statement he asked how many soil surveyors the Experiment Station of Oklahoma financed each year. With some little hesitation the question was referred to Dr. Fenton Gray of the Experiment Station, and he stated that the Oklahoma Experiment Station had no soil surveyors at the present time. The interesting thing about this figure is that $600,000 represents more money than all of the 13 Southern States are putting into soil survey at the present time.

Also the Conference discussed the idea of meeting once every two years--alternate with the National Conference.

Policy Suggestions

A number of suggestions have been sent in which involve policies. They are as follows:

1. New topics which have originated in the National Conference should be referred each year back to the Regional Committees for consideration and edification.

2. A Glossary Committee should be set up to keep all teaching personnel informed on terms that are used by the soil survey personnel of the Soil Conservation Service.

3. More follow-up work on yields and response by soil type and phases should be done at the expense of the soil survey mapping program.

4. Land Grant Colleges should have more representation at the National Soil Survey Work-Planning Conference.

5. A public relations committee should be set up in order to keep the public well-informed, particularly Land Grant College people and agricultural workers as to developments in the soil survey program.

Problems in Soil Survey and Soil Classification in the Southeast

The following problems have been mentioned and are presented for the consideration of this Conference:

1. The silt content of many of the Coastal Plain soils are not holding true to official descriptions; for example, many of the the Coastal Plain soils such as Savannah, Shubuta, Boswell, Ora, Bladen and Ruston are quite high in silt content. Some of them are actually silt loams in the surface layers and silty clay loams in the subsoils. This poses a problem in classification, and it seems as if we shall have to amend the official descriptions to include soils with high silt contents or set up new series. This is a problem that will probably require some interstate field reviews.

2. The separation of series on the basis of the underlying materials which are 48" deep is also posing a problem for the soil surveyors in the field.

3. The term "local colluvium" has been suggested for "local alluvium".

4. The term "wet" has been suggested for "moist" in the determination of soil colors. It seems as if the amount of moisture in a

moist soil varies among the people who examine the soil. It is suggested that colors be determined under wet and dry conditions rather than under moist and dry conditions.

5. The color range of some of our red soils such as Ruston and Orangeburg is posing a problem in the separation of these two soils in the field.

Publications

1. The type of publication that should be made for soil surveys is a question very much in debate at this time. This problem is handled in some States by two or more publications. It seems as if the technical county soil survey reports are getting more complicated and longer each year. It is extremely difficult to include all of the material and information in a comprehensive soil survey report and at the same time make a popular publication. It has been suggested that the idea of trying to please everybody be abandoned and a technical comprehensive soil survey report be made mainly on the soils of the county or area involved. Then from this technical report the various specialists could make leaflet reports in the various fields of agricultural services. This is a procedure somewhat similar to publications now issued by the Extension Service which are in reality leaflet excerpts from technical Experiment Station reports.

2. A request was made that it would be interesting to know when the Soil Survey Manual No. 18 will be revised and published again.

It is understood, I am sure, by the members of this Conference that I do not personally concur in all of the problems and suggestions made in this report. I am trying to represent the prople who elected and sent me to this Conference, and that is the reason I have submitted all of the above problems and suggestions for your consideration.

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Notes on Mr. Hockensmith's Discussion of Plans for 1959 National Conference

We are not certain at the present time whether a national conference will be held in 1959.

Committees Nos. 8, 15, and 16 at this year's conference were voted to be dismissed. These recommendations were accepted by the conference.

The general policy is to rotate both the committee membership and chairmen with enough members of previous committees being retained to assure continuity of work. The committee chairmen at the regional conferences are assigned wherever possible to comparable national committees.

An explanation was given on how land-grant college representatives are selected and assigned to national committees. The chairman of each of the four regional soil survey work groups or subcommittees of the four Regional Soil Research Committees are given an opportunity to assign land-grant college soil survey leaders to the committees.

There has been general complaint that committees are too large, making it difficult to reproduce materials and difficult to get very many to work on job of committee. The group agreed that committee membership should be limited to 5 to 8 people with, perhaps, exceptions in some cases. It was pointed out that others (nonmembers) may submit contributions to the committees. This is highly desirable.

When committee chairmen have been designated, Mr. Hockensmith will write to each chairman for recommendations as to others whom the chairman would like to have serve on his committee and also as to others who, although not members of committee, should be encouraged to contribute to work of committee.

It was recommended that the scope of the committee on improving soil survey procedure be officially expanded to include soil correlation procedures. This was agreed to by the conference.

It was recommended that the scope of the committee on use of published soil maps be officially expanded to include evaluation of soil survey reports. But it should confine activities in this regard to evaluation studies. This will avoid possible duplication with work of committee on soil survey interpretations. This was agreeable to the conference. Establishment of committee on form and content of soil survey reports should be postponed or delayed until more information from evaluation of current reports is available.

It was pointed out that regional conferences in the southern and northeastern regions may not be held in 1959. Apparently some misunderstanding exists about these conferences.

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Some Aspects of the Soil Survey Program In The North Central Region

H. P. Ulrich

Following Mr. Hockensmith's suggestion I will speak briefly of some accomplishments in the North Central region.

The North Central Regional Conference of Federal and State workers in soil survey was sponsored by the North Central State regional soil survey subcommittee. It has been held annually during the past four years. They have held effective and mutually profitable meetings for the study of various phases of the survey program and we hope that they will continue to be held. This year after some question arose as to the exact name, an official name was selected and a study initiated to outline the functions of this joint meeting. This appears to be necessary in part to avoid duplication in a somewhat similar meeting now being held by the regional correlator.

The North Central Committee of State soil survey leaders will complete this year its 2nd project, the bulletin "Major Soils of the North Central States". Publication of this bulletin has been delayed. As now being completed, it will be improved by the addition of representative landscapes and profile diagrams and a section dealing with the principal management problems affecting land use, the soils on which they are being investigated, and gaps or overlaps in the current research program. This bulletin will make a worthwhile contribution to a knowledge of the soils of this region. Although a new project has not yet been selected, favorable consideration has been given to treatises on genesis and classification of the soils of the region.

The selection, study and assembly of data on Benchmark or Key soils has been one of the more recent developments in the field of soil interpretation. Two questionnaires have been circulated on this subject in the last three years by a work group under the guidance of the National Soil Research Committee. The more recent one has asked for a report of progress on the assembly of this information.

This year the joint committee on Soil Interpretation and Soil Reference of the North Central Technical Workshop of the Cooperative Soil Survey, took definite action in selection of representative soils from each of the Great Soil Groups to begin assembling available data. Many field experiments have been conducted by the experiment station on response of certain soils to liming, fertilization, crop sequence, etc. in the several States but much of this data is unpublished or unavailable. In some cases the soils are not correctly classified, nor mapped in sufficient detail to evaluate the response. In some cases insufficient laboratory data has been secured to correctly characterize the soils

and aid in interpretation of the response to treatment. Correct identification of the soils, assembly of available data on the physical, chemical, mineralogical characteristics and data on response to the management problems investigated will provide valuable and reliable information for the interpretation of the Benchmark soils. A large number of soils with similar characteristics and properties on which little or no information is available may then be related to the Benchmark soils. The assembly of this information will show where further research is needed and aid in development of a research program around key soils and management problems. We believe that this is a fertile field for study in soil interpretation and urge that consideration be given to its development on a national basis by this conference.

The third point of discussion is that of laboratory data as an aid in improving the classification of soils. Three years ago a field study of the Menfro soils of Missouri, # 160, Alford and Hosmer soils of Illinois, and the Alford and Hosmer soils of Indiana was undertaken. Much supporting laboratory data on the physical and chemical properties was available, some of it collected and reported in the Clinton-Fayette study, North Central Regional Bulletin #46. This field study showed marked similarity in the morphology of Menfro, Illinois # 160, and Alford, resulting in the suggestion that they be combined. In 1956 a field and laboratory study of the Alford and Hosmer soils was undertaken. The Hosmer has marked differences in morphology, chiefly more intensive leaching, and a developed fragipan. Analysis of data on the other soils did not show any significant differences either morphologically, physically, chemically or mineralogically for retaining 3 soil series. As a result, it was recommended that they be combined as the Alford series. The laboratory data did indicate an apparent increase in clay content of the B horizon of about 5% from east to west. Field observation of the Menfro soils indicated more angular blocky structure and gray silt coatings on the aggregates.

Similar problems in classification are known to exist in Indiana with neighboring States and probably elsewhere that could be examined and resolved with the aid of laboratory study. Since a decrease in the number of established soil series is rare, should not more consideration be given to a study of the physical and chemical properties and their significance in the creation of new series and the retention of some established series?

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Dr. Kellogg's Summary of the Conference and of the Work Ahead

Conference next year:

The pressing need for having the national conference in 1959 has been questioned by several. It is true that considerable effort will need to be put forward and concentrated on completing the new system of classification if it is to be ready for publication prior to the 1960 Congress of the International Society of Soil Science. Also, it is uncertain what funds may be available for conferences during the fiscal year 1959. A definite decision will be forthcoming later.

Horizon nomenclature:

Possibly this committee has actually been dealing more with horizon definition than with horizon nomenclature. Further, it seems that one of our big difficulties has been an attempt to develop one set of criteria in horizon definition and nomenclature for three quite different uses:

1. By relatively inexperienced soil scientists while mapping in the field;
2. By experienced soil scientists working rapidly in the field; and
3. By skilled soil morphologists necessarily taking considerable time to examine profiles in places of intensive study where the field observations are commonly supplemented with laboratory data.

The detail that is required for adequate work varies in these situations. After some recent conversation with Dr. Cline, we believe that the committee should try to develop two different but consistent sets of schemes for horizon designation. One set would be used by our field men engaged in ordinary soil mapping work and the other set would be used by those making highly detailed examinations. With the two sets completely consistent, it would be possible for individual profile descriptions made with the simpler scheme to include some of the detail from the second set, but not necessarily all of it. I suggest that we ask Drs. Cline, Smith, and Simonson to take a look at the problem from this point of view and make some early recommendations. There is need for considerable haste for decision on definitions of horizons since whatever we use in the future should be consistent with whatever we use in the revised system of classification.

Soil Color:

The addition of a chart for gleyed soil expands the coverage of our color chart and gives us an opportunity for a brief statement about the chart as a whole. I suspect that other scientists and engineers would use it if they knew about it. I hope that Mr. E. H. Templin may find it possible to prepare some brief statements for publication, especially in Science.

Classification of organic soils:

As Dr. Dawson has explained, further study has resulted in some substantial changes in the tentative scheme of classification of organic soils. These newer proposals have not been subject to field test. I hope they can be tested as soon as possible. Dr. Dawson indicates that he has in mind tentative plans for testing in New York, Michigan, Minnesota, North Carolina, and perhaps Washington. It is suggested that Dr. Dawson firm up these plans with Dr. Smith and others and schedule them as soon as practicable. Results of this work are also essential for completion of the scheme of soil classification.

Soil surveys for range use:

This committee, with the help of other committees organized by the Service, has made substantial progress as evidenced by the discussions and by the report of the recent workshop of range conservationists and soil scientists. In the report of the workshop held at Phoenix, it is not quite clear that yield data on ranges must be first collected and analyzed by taxonomic soil units rather than by mapping units, although summaries will be made by soil mapping units and by range sites.

Soil surveys for forestry use:

We have two rather different but overlapping problems in this field that are becoming clarified. In much of the eastern part of the country, for example, soil maps are available or will be available that are designed primarily for use in relatively intensive agriculture. Much of the woodland in these areas will be mapped by the same legends. Our biggest problem in such areas is the matter of interpretation and groupings of these rather detailed mapping units in terms of adapted species, forest site indices, and other relevant qualities affecting forest management.

In a great deal of the mountainous country of the west we have the problem of designing de novo both the classification and the mapping to fit the needs for extensive use in forestry. Many of these areas are rough and mountainous, difficult to traverse, and with very complex patterns of soils in relationship to such individual characteristics as depth, stoniness, texture, slope, and so on. Of course, we shall need to set up soil types and phases that are defined in these terms but they cannot be used directly as mapping units to make maps that would be reasonable in cost and useful in forest management. Many of the soils in these areas have not been carefully studied and we shall have a considerable problem of correlation and classification. But in addition, we have a problem of map design, or perhaps I should say legend design, to get useful maps. The soil scientists working on these surveys will need a great deal of assistance from foresters. Forest-site index is only one of the factors involved. We shall need help on the whole range of engineering practices, logging practices, and so on. Besides, users will want to be able to interpret the maps to help in selecting recreational areas, wildlife preserves, and so on.

I am hoping that we shall be able to appoint a man on our staff to work on these problems with our cooperators in the experiment stations and the Forest Service. Some trials have been made and a good many are under way and I hope we can generalize some firm principles from these experiences.

Small-scale soil maps:

Our committee has done an excellent job on this assignment. You have seen examples of good State soil maps that can be read easily by the non-soil scientists and they also contain a lot of detail for the soil scientists. In the past the Department of Agriculture has not published such State soil maps, partly because of our heavy load of publishing detailed soil maps and partly because we feel that the State use is so dominate that the work more properly is a function of the State experiment station. That has been the policy and I don't anticipate any immediate change in it, although of course, any suggestions for change will be given consideration. To be useful such maps need to be accompanied by a text and I hope that both the map and report are worked out jointly in terms of basic national standards, such as those developed by the committee.

The committee has pointed out that most of the maps being developed now are really soil maps, although many of them are called "land resource maps". In our original planning of these maps in connection with the conservation needs study it was thought that many of the soil mapping units might be subdivided by dashed lines in accordance with identifiable differences in water resources and other land features. In practice, however, it appears that very little such subdivision has been done and that the products are soil maps. You will note that the committee suggests that the best name is "Soil map (generalized) of ______ State".

We need the same kind of study of the small-scale maps that are to be included in soil survey reports. Dr. Steele and Mr. Orsini can furnish the committee with several examples that are now in process of publication.

I am sure that the committee will find some of these much better than others. I recognize that the need for such small-scale maps has increased since most of the published soil surveys now include detailed soil maps on relatively small sheets on aerial mosaics. I am hoping that the committee can give us some recommendations of alternatives in style and scale bearing in mind not only readability, but also costs. Perhaps we can follow some general standards in terms of map style and numbers of units shown on the map but, of course, we cannot follow any kind of national standard on homogeneity of the units because some counties have patterns of very similar soils and others have patterns of very dissimilar soils.

Climate in relation to soil survey:

We have had some good discussions of this very complicated subject. We must continue to explore the possibilities of making full use of all available data on crop yields in relationship to climatic data in order to arrive at the best possible guide lines of hazards and risks. It has been my hope that by making very

careful studies of the climatic data where there are long time yield records we could develop principles for interpolation to other areas where yield records were not very good. We know that near the tension zones we cannot follow either climatic data or soil classification exclusively, because of the interactions between the soil and the climate. We know that areas of the same kind of soil can be found on either side of a critical rainfall line or a critical temperature line. We know that we are going to have some difficult boundaries to draw since changes in climate are gradual in many places. Still I think we have great unrealized potentialities for relating climatic data to soil classification for a more nearly adequate evaluation of risk with each kind of soil or rather, perhaps, with climatic phases of each kind of soil.

Engineering interpretations:

We have moved a long way in this important area. The soil scientists have had excellent cooperation from engineers within the Soil Conservation Service, in the Bureau of Public Roads, and in several State highway departments. Ordinarily the work goes a bit more smoothly where preliminary discussions are had between the engineers in the Bureau of Public Roads and engineers of the State highway departments before we approach them for detailed help. Now, of course, I hasten to add that this work is already cooperative with several State highway departments who have much to contribute. But we must recall that not all State highway departments use the same laboratory methods in soil mechanics as those used by the Bureau of Public Roads and by the majority of State highway departments.

Several chapters for soil survey reports have been prepared and others are under way.

It is suggested that Mr. Orvedal, Dr. Steele, and Mr. Klingebiel arrange for the preparation of a statement on the present status of our cooperation with other agencies on this important phase of soil survey interpretation.

I should add that with the greatly increasing interest in the use of soil surveys in urban and suburban areas, this phase of interpretation will be increasingly used.

Soil family groupings:

The committee pointed out that the correspondence between phases of soil families and capability units would not be perfect in some instances because of great differences in the intensity of agriculture and differences in climate. It is clear, however, that we have no better system for checking the composition of capability units than through the grouping of phases of the series in the soil family. Where we find misfits, we must check to see whether they are real - whether there is a real reason for the lack of correspondence - or whether there is a mistake in one grouping or the other.

Since we are now reworking both the groupings into low families and the groupings in the capability classification, this is the ideal time for us to look at

both together and check one against the other. At the moment we are in no position to assume that either is catholic. The capability classification can give us clues on family groupings and the family groupings can give us clues on capability groupings.

Bench mark soils:

It was pointed out clearly that the selection of bench mark soils and the synthesis of all available accurate data relating to them can be very useful in giving us standards for both soil correlation and interpretation. I am hoping this activity goes forward in all parts of the country, fully cooperative between the Service and the State experiment stations.

At the same time I do want to emphasize that the collection of crop yield data cannot be limited to the bench mark soils. We need to have the best estimates we can make of the yields of adapted crops on all soils and to have them in our soil handbooks just as soon as possible. The sooner we make these draft tables the more quickly they can be used and the more adequately they can be criticized by all our fellow workers.

There has been some criticism of yield estimates since they do change over periods of time with changes in techniques. I appreciate that the productivity ratings or productivity indices also change, but far more slowly. I should prefer that our handbooks and reports have both yield estimates in absolute terms and productivity indices. Many people use our reports who do not know from their own experience what a good yield ought to be. They can interpret that from the productivity index. They can also make some general but useful comparisons among widely distant areas growing unlike crops through the productivity indices.

Use of published soil map:

We are all gratified with the report of the committee indicating that there is a stepped up use of the older maps in farm planning. Perhaps some of the psychological barriers have been removed. Of course, no one can insist that we use all these maps, published since 1899. The use of some published maps may depend upon some enlargements and some additional lines to be placed on the maps either by soil scientists or by soil conservationists. The committee has rightly emphasized that no detailed generalizations can be made of how to use these older published soil maps in farm planning: Each one will have to be studied on its merits in relation to the local problem. But it is clearly evident from the committee's work that a great many older soil maps can be used with additional work and cost far below the work and cost of resurveys.

Management of soil surveys:

Partly due to the work of our committee and partly due to additional work in Soil Survey Operations, both in Washington and in the State offices, a good deal has been done to improve the efficiency of soil mapping. This is borne out clearly by our recent accomplishment records for 1957. Some areas and some States have improved enormously. That, of course, pleases all of us; and I

think we can all see great unrealized opportunities for further improvement. We do need to caution ourselves, however, that we want not only as much coverage as possible with our facilities, but also high quality. If the field mappers get the idea that all we want is quanity, they will give us quantity. We must make it clear that we need quality as well. I am not suggesting that quality has gone down. On the contrary, I think it is much higher. But the two - quantity and quality - must be in balance. Then too, I believe the improved management is helping us to remove our greatest bottleneck to prompt soil correlation, which has been the lack of field preparation for correlation, especially soil descriptions and descriptive legends (or handbooks).

Soil survey report manuscripts:

We need to emphasize again that we are running dangerously close to the edge in our publication program. The need for completing soil survey manuscripts on schedule is extremely urgent. Soil correlation or any other work serving as a bottleneck for report writing needs very high priority indeed.

Soil survey laboratory work:

We need also to stress the importance of scheduling the laboratory work in relation to the completion of survey areas and especially right now in relationship to the grouping of soils in the new system of classification. Any samples taken for this purpose should be planned for almost immediately so that the data may be available in time for interpretation and soil grouping.

Cooperation with the State experiment stations:

The contributions of the State experiment stations to the soil survey program are considerably greater than we might realize from looking at their financial contributions alone. We lack a good national figure on what the financial contribution amounts to. I suppose it is somewhere around $800,000 to $1,000,000, but I am not sure. We do know that generally over the years our best product has come from the joint efforts of both staffs. We know that the greater the responsibility that the experiment station people feel for the work, the more adequate are the interpretations. We have had recently some increases in effort by the experiment stations and I hope we can look forward to some more.

Of course we all want the experiment station people to take a responsible interest in our program and our problems. Yet we must always recall that this is a two-way relationship. We can only expect them to take a responsible interest in our problems if we take a responsible interest in their problems and their responsibilities. Sometimes problems arise in these relationships because of a lack of understanding. We must always be mindful of the need to keep them fully informed and to help them in any way we can. Perhaps this is another way of saying that the most important aspect of cooperation is the spirit of cooperation growing out of better understanding and mutual feelings of responsibility for the many important problems for the solution of which soil studies and soil surveys are being made.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Land Grant College Representative of the Northeastern States

Marlin G. Cline

In the absence of the Chairman of the Northeastern Soil Survey Work-Planning Conference, the report was given by M. G. Cline, who emphasized that the statements made and opinions expressed in no way implied endorsement by the Land Grant Colleges or the Northeastern Conference, from whom no charge had been received.

The Northeastern work-planning conference was reviewed briefly without specific reference to activities of the 10 committees that had reported, copies of whose reports had been distributed to comparable committees of the National Conference. The history and purpose of the Northeastern meeting were reviewed briefly, and the question of whether or not an annual meeting is justified was raised. It was suggested that the meeting serves a very useful purpose but that a meeting in alternate years, possibly supplemented by selected field conferences or projects in the intervening years, should be considered.

The general status of soil surveys in the Northeastern States was reviewed. It was pointed out that the contribution of the States ranges widely, from a substantial portion of the total to essentially none. In most instances the State contribution is very limited and below the minimum required in the State's own interests.

It was suggested that, although conversion of Conservation Surveys to Standard Surveys has been substantial in name and in the development of mapping legends, the process was complete in very few areas due to failure of field scientists to complete descriptive legends and similar essential details. To a considerable degree this reflects the status of training of field scientists and failure of some administrative supervisors to recognize the necessity of these details for conduction of a good survey.

A decrease in rate of mapping during 1957 in some States was noted and attributed to the time required for special projects, such as the Conservation Needs inventory. In one instance, withdrawal of State-supported mapping time for other essential jobs was primarily responsible. This included revision of Conservation Survey mapping, preparation of adequate legends in new or Conservation Survey areas, and training of personnel. It was suggested that rates of mapping could be greatly increased by progressive instead of spot mapping and that the efficiency of most personnel is limited by lack of ability for landscape interpretation for prediction of soil mapping units. Too many men depend primarily on the soil auger or spade and are unable to make the predictions necessary for both rapid and accurate mapping.

The need for training both of those already in service and of new men was emphasized. Generally the progress of those capable persons in service has been amazing considering their status only 4 years ago. Consequently, it must be assumed that in-service training has been good. The trainee program is a most promising development of the past 2 years for new personnel. The question was raised, however, as to whether new personnel are trained most efficiently by assignment individually to an experienced man or whether group training would be more efficient. It was emphasized that, however accomplished, training time of both the trainee and the teacher should be recognized as teaching and not production time. The concept that a field scientist can train a man during regular mapping duties is false. Either the trainee is neglected or the field scientist sacrifices production for 2 or 3 months under these circumstances.

UNITED STATES DEPARTMENT OF AGRICULTURE
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NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Committee on Soil Surveys for Range Uses

The 1958 Conference Committee met in St. Louis on March 26, 1958.

Regional Committee Reports

The committee reviewed the report of the committee on "Surveys of Range and Forest Lands" of the Western Regional Conference, and the report of the committee on "Soil Surveys for Range Uses" of the Southern Regional Conference. This committee agreed with most of the information in these reports and a few items are considered under specific subjects.

Both committees were discontinued.

SCS National Range Workshop, 1958

The 1958 National Range Workshop of the Soil Conservation Service was a joint meeting of soil scientists and range conservationists. It was held at Phoenix, Arizona, January 21-24, 1958. Eight members of this committee participated in the workshop, and they believe it was very productive.

The report of the workshop was reviewed by the committee and summarized for the conference by Fred Renner.

Recommendation: No. I.

> The committee endorses this type of workshop and recommends that the report be studied and used by people concerned with range.

Soil-Range Research Team

A research project studying the relationships between soils and native grasses was initiated by the Soil Conservation Service in 1957. The research team consisting of H. B. Passey, Range Conservationist, and Vern Hugie, Soil Scientist, is located at Salt Lake City, Utah. This project was reviewed for the conference by W. M. Johnson.

Minimum Size of Delineated Areas

The report of the Western Regional Committee on Surveys of Range and Forest Lands included the following statement on page 2:

> "Much of the Western commercial forest or interspersed commercial forest and range land is justifiably mapped at an intensity of 10 acres or less as a minimum area of delineation separating soils of contrasting behavior."

This committee questions the advisability of a general specification of minimum size of delineations. The establishment of a minimum size for a specific soil mapping unit in a specific survey area may be desirable at times.

Our taxonomic classification is of such great detail that the mapping unit will rarely be the soil phase but rather an association of soil phases and other units in soil surveys of our range lands.

Cartographic detail is consistent on the same soil-landscape whether in range or field crops in areas of interspersed range and cultivated land.

Recommendation: No. II.

> The committee recommends that the relevant significance of the soils and their potential productivity be used as a basis for determining the size of delineations on soil maps rather than any arbitrarily established minimum size in acres.

Publication of Soil Surveys of Different Intensities

The problem of publishing soil surveys of different intensities was discussed by the Southern Regional Committee and the National Committee. This problem is common in the west where irrigated and range lands exist in the same county. Where it is feasible to publish on one scale, there is little difficulty. However, where different scales are appropriate, careful planning is necessary. Two or more alternatives exist. One, all of the survey area may be published on the smaller scale, having generalized the high intensity mapping, and in addition, publishing on the larger scale the high intensity mapping. Two, publishing part of the county on the smaller scale and the rest on the larger scale.

Small isolated surveys of high intensity probably should not be published. These may occur where there is a little development of pump irrigation or diversion from small streams.

Recommendation: No. III.

> The committee recommends that where different intensities of mapping and different scales exist, definite plans for publication scales be developed at the start or during the early stages of the survey.

Methods of Grouping Mapping Units

Two methods of grouping mapping units are used. Method A is to group the mapping units directly into specific interpretive groupings such as water yield, range site, habitat suitability for a wildlife specie, capability unit, and woodland site indices. Method A may be illustrated as follows:

Interpretive Groupings

Mapping Units → Water yield
→ Range sites
→ Picnic areas
→ Capability Units
→ Wildlife habitat
→ Woodland site indices

Method B is to group the mapping units first into capability units and then to group the capability units into other interpretive groupings such as woodland site indices, habitat suitability for a wildlife specie and range sites.

Method B may be illustrated as follows:

Other Interpretive Groupings

Mapping Units → Capability Units → Water yield
→ Range sites
→ Picnic areas
→ Wildlife habitat
→ Woodland site indices

The Southern Regional Committee on Soil Surveys for Range Uses considered the relationship of land capability and range site groupings. They concluded that:

"It appears impractical to attempt to coordinate the two systems."

Recommendation: No. IV.

The committee recommends that Method A be used.

<u>Economic Interpretation of Range</u>

Economists look to the physical scientists for the basic physical predictions necessary for economic studies. Lack of physical predictions, in many instances, perhaps most instances, is the main reason for the lack of economic analysis.

Dr. Ottoson of the Agricultural Economics Department, University of Nebraska furnished the committee with a rough draft of a manuscript entitled "Physical Data and Economic Interpretation in Range Management". The purpose of this manuscript was to help the committee evaluate the suitability and availability of data and predictions necessary for economic studies of range land. One of the more difficult economic analysis is that of comparing the use of a soil pattern for range with its use for cropland.

The committee reviewed the manuscript and in general agreed with the concepts presented. They did have some trouble with the terminology and suggested that it be written in less technical jargon in order that more people could read it with understanding.

The committee agreed that there is considerable lack of physical data, however, they do believe that much information could be brought out of the files and other places.

Recommendation: No. V.

The committee recommends that existing data be assembled more rapidly, that greater emphasis be placed upon the collection of yield data on range land and that efforts in the area of soil-range-economics be continued.

Future Status of Committee

The committee reviewed its past accomplishments and objectives. There appeared to be some need for a shift in its approach and activities.

Therefore, it is recommended that the committee be continued with its objectives and membership revised along the following lines:

1. To identify problems concerned with soil surveys on range lands that require further detailed consideration.

2. Develop means for the study of such specific problems, including the assignment of subcommittees or task forces for the purpose.

3. Review and report the recommendations and findings of such subcommittees to the National Soil Survey Work-Planning Conference.

4. Report other developments of interest to the National Soil Survey Work-Planning Conference.

5. Reduce the membership of the committee to approximately 8 persons, and revise the membership to secure the services of individuals concerned with soil surveys of range land.

Committee Members:

*A. R. Aandahl, Chairman	W. W. Hill	R. M. Marshall
Glenn A. Avery	Vern Hugie	*C. A. Mogen
*D. R. Cawlfield	Milo James	Howard Passey
*Ray W. Chapin	*W. M. Johnson	*F. G. Renner
Arvad J. Cline	R. C. Kronenberger	*J. D. Simpson
John A. Elder	Marvin Lawson	F. C. Westin
*R. D. Headley	H. J. Maker	*LeMoyne Wilson
Arnold Heerwagen	Ray Marshall	L. R. Wohletz

*Those who participated in committee meetings at the St. Louis Conference.

Visitors at the committee meeting included W. H. Allaway, John Retzer, and R. H. Rust.

Comments

Kellogg: Many of our practices and shifts in land use would be adopted or achieved faster if we had better economic information.

We will need to learn at least a few of the economic terms.

Swanson: Did the research team contact the State Climatologists?

Johnson: I don't know, but they are seeking assistance and information from all sources.

We do need data on the moisture regime in the soils studied. This invokes a serious problem of instrumentation.

Allaway: Paul Nixon at Lompoc, California, is getting some data. The neutron meter may be useful.

Retzer: We should coordinate our method of obtaining yield data.

Smith: We need assistance from economists to make sound interpretations because economic assumptions often exist but are unknown to us.

Rust: Linear programming is a relatively new tool of the economists which integrate the total farm operations. It appears to be useful.

Kellogg: We need to meet the economist in understanding the use of economic analyses needed to service the nation's agriculture.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of Committee on Soil Survey Interpretation (General), Including Capability Classification and Assembling Basic Data

The committee this year considered four projects in developing its program: (1) further work on the definitions of the categories and groups of the capability classification and the assumptions and criteria used in the operation of the system, (2) the development of a means for collecting data on benchmark soils to be used for soil interpretation and correlation, (3) the organization of the soils handbook, and (4) construction of a manual to be used as a guide for those concerned with interpretation of soil survey data.

The 1957 committee work was devoted exclusively to the clarification of the capability classification. Since then, additional work has been done on expanding and refining this material and a memorandum prepared and sent to the field for review. Since all soil conservationists, State soil scientists and others reviewed this recent draft of the capability classification, and since time did not permit a full evaluation of these comments for consideration by the committee, the committee felt that for the present it could work more productively on the other topics. There is more work, however, that can well be done on the concept of the capability units and the procedure by which soils are assigned to them.

The Soils Handbook

Some time was spent by the committee discussing the relationship of the soils handbook to the technical guide and the content of each. Administrator's Memorandum No. 47 sets forth the content of a soils handbook. In addition, a number of outlines for soils handbooks have been prepared as well as the soils handbooks themselves. Briefly, the soils handbook contains a descriptive legend of the survey area, together with basic interpretations and other information pertinent to the understanding and use of the soil map. It does not include standards and specifications for management practices.

A technical guide, as described by Messrs. Blakely and Silkett, is an assembly of information that is used by technical people in the Soil Conservation Service as a guide in helping farmers and ranchers plan and apply soil and water conservation practices. A technical guide is generally prepared for a Soil Conservation District or Land Resource Area. It is composed of:

1. Soil survey information and interpretations of it.

2. Essential standards and specifications for planning and applying conservation measures.

3. Other management and cultural practice information needed to further improve and develop the program.

The committee agreed that the soils handbook is a part of the technical guide and that there need not be any duplication of effort in the development of these materials. The technical guide, however, may contain additional soil interpretations that are related to kinds of soil that would not be considered a part of the soils handbook. Information on the proper spacing of drainage ditches is an example of this kind of interpretive material.

Outline for Collecting and Assembling Data on Benchmark Soils

The committee recognizes the need for collecting data on benchmark soils so as: (1) to better characterize soils for correlation, especially correlation of those extending across State lines or being in two regions, and (2) to aid in developing interpretive data and standardizing it so far as is reasonable.

The committee reviewed the regional reports that dealt with working out a procedure for collecting data for benchmark soils. The Committee of the Northeastern Region developed an outline for "Collecting and Interpreting Crop-Yield Data Related to Specific Soils". The outline recommended:

1. Collecting data for key or benchmark soils to be used as a framework for interpretation of the data.

2. Selecting one man in each State, preferably a representative of the State experiment station, to be responsible for collecting the data.

3. Correlating the soils on all experiment station and field plots where yield and management data may be obtained.

4. Interchanging yield data between States.

5. Evaluating existing research data on yields on specific kinds of soils under defined management.

The Committee of the Western Region reviewed a previously prepared outline which essentially called for:

1. A detailed description of the soil.

2. Measurement of chemical and physical properties.

3. Statement of the important soil qualities.

4. Statement and interpretation of climatic data.

5. Yield data with specification of the management under which the yields were obtained.

The Western Regional Committee recommended that this outline be adopted as a guide for collecting factual data about benchmark soils, that benchmark soil sites be located, and that work be done to establish a means of integrating the combined climatic effects at a sample or collection site.

The North Central Committee has gone into quite some detail in developing a procedure for collecting benchmark data and has data collected for a few benchmark soils. This national committee considered all of the reports, but dealt chiefly with the North Central outline.

The North Central Regional Committee realized that there is a great need for interstate information and that many times a State is not now familiar with the availability of information in other States. It recognized that the benchmark project was going to be a time-consuming job and that it was quite important that benchmark soils be selected on which work would be concentrated. The essential features of the North Central project and the activities so far are about as follows:

The North Central Committee, after much deliberation over the entire project, proposed the following procedure:

1. That a booklet be prepared for each major soil series, which would give basic information about the series.

2. That an outline be prepared as a guide for assembling and presenting this information.

3. That soils be selected as benchmark soils for which this data will be assembled.

4. That a trial run be made in 1958 for the purpose of exploring the possibilities of this type of approach.

The regional committee proceeded to select the benchmark soils (about 60 series). It was agreed also that: (1) only well-trained and experienced men would be assigned to the job of collecting the benchmark data, (2) one State would be responsible for the gathering of all information on a particular soil, and (3) this State would contact the other States concerned and get the information from them.

For the 1958 trial run:

1. Each State was asked to select soils on which they preferred to work (five in all, listed in order of preference).

2. The States are to review the list of approximately 60 series, and add and delete for the purpose of improving the list of benchmark soils.

3. The leadership for the 1958 project in each State will be the survey project leader of the experiment station and the State soil scientist.

4. Each State team will collect all of the pertinent data, prepare a summary in accordance with the outline prepared by the regional committee, and have this summary reproduced for all members of the conference for their review before the 1959 regional conference.

It was recommended that the 1959 conference, after reviewing the 1958 trial run, decide on: (1) an outline, (2) a report format, (3) means of publishing the report, and (4) the final selection of benchmark soils for the five-year program.

A summary of the tentative outline prepared by the 1958 regional committee is as follows:

I. Description of the general setting for the series.

II. Occurrence.

III. Brief discussion of genesis.

IV. Physical and chemical characterization.

V. Other information--climate, root distribution, etc.

VI. Use, management, and response.

   A. Agricultural crops.

   B. Woodland.

   C. Engineering.

   D. Irrigation.

   E. Drainage.

   F. Wildlife.

   G. Recreation.

   H. Rurban development.

VII. References.

The national committee, after reviewing the North Central 1958 report, recommended: (1) that all the regional committees promote benchmark projects along the lines of the North Central plan, and (2) that the outline be adjusted to separate clearly the basic from the interpretive data.

The national committee, after discussing and reviewing the three regional outlines, prepared and recommends the following outline as a guide for collecting and presenting benchmark soil data:

Outline for Collecting and Assembling Data on Benchmark Soils

I. General statements about the series.

A. General characterization of the series.

Great soil group, parent material, position on the landscape, drainage, slope range, nature and relationship of associated soils, proportion cleared, present use.

B. Distribution.

1. Include a soil association map that embraces all significant areas of the series.

2. Total area and distribution of area among the associations and by States.

C. Geology.

Nature and source of its parent material.

D. Physiography.

Include a block diagram showing the nature of the landscape and the position of the series and its associates.

E. Climate.

Temperature, precipitation, wind, humidity, air drainage, and interpretations as to how they affect plant behavior.

II. Description of the series.

A. A short statement on the history of the series--when and where established, stages in the refinement of the concept of the series.

B. Significant statements about the genesis of the series.

C. Official series description.

If the official description is not adequate, supplement or modify it in order to make the description adequate.

III. Description of the mapping units for which data is obtained.

This can be written as a supplement to the series description, consisting essentially of statements of the differences between the profile described for the series and that of the mapping units.

IV. Measurements of soil properties (for mapping units).

A. Mechanical analysis, including coarse fragments.

B. Bulk density.

C. Water-holding capacity (at critical atmospheric pressures).

D. Permeability of undisturbed material.

E. Maximum density, liquid limit, plastic limit, optimum moisture.

F. Clay types and petrographic data for the sand fraction.

G. Reaction (by pH determination).

H. Concentration of salts (by electrical conductivity).

I. Cation exchange capacity and exchangeable cations by horizons.

J. Soluble cations and ions, when needed.

K. Calcium carbonate.

L. Total nitrogen and C/N ratio.

M. Organic matter or organic carbon.

N. Available nutrients.

O. Total gypsum.

P. Free iron oxides.

Q. Amount of water stable aggregates.

V. Soil qualities (for mapping units).

These are inferred or interpreted from laboratory data and field observations.

A. Fertility status.

Obtain by inference from laboratory data, experiments, and field observations. Fertility of both surface and subsoil material should be evaluated. Level of fertility (high, low, etc.), distribution in profile, level of permanence, chief limiting nutrient or nutrients.

B. Erodibility.

Obtain by inference from physical properties, field measurements, and observations. Include data on rates of soil loss for different practices and soil conditions.

C. Air and moisture regimes.

1. Available moisture capacity and effective rooting depth.

   Determined essentially from moisture equivalent and thickness of the separate layers down to material that is not a part of the effective root zone.

2. Permeability. (Use standard terms.)

3. Degree and periods of aeration; viz., degree and periods of excess water, including movement of the water table and flooding experience.

VI. Data by mapping units on yields and the conditions under which they were obtained.

A. Commonly grown crops.

1. Measured plots in controlled experiments.

2. Measured field observations.

   Elements of management under which yields in 1 and 2 were obtained should be stated. Kind and rate of fertilization, crop sequence, additions of organic matter, amendments, tilth conditions, weed and pest control, etc.

B. Range and pasture.

C. Woodland.

D. Special crops.

VII. Predictions (yield estimates by mapping units for this soil series).

A. Yields of specified crops for the mapping units under specified management. (Indicate which data are based on actual yield measurements and which are estimates.)

B. Pasture and range.

C. Trees as sources of wood products.

VIII. Data related to other uses, chiefly engineers.

A. Information significant to highway construction.

1. As highway sites.

2. As source of useful material.

(a) Sand and gravel.

(b) Subgrade.

(c) Fill.

(d) Topsoil.

B. Information significant to its use for dam structures.

C. Information significant to its improvement by drainage.

D. Information significant to irrigation.

1. Land smoothing requirement (for flood irrigation).

2. Infiltration.

3. Frequency of irrigation required.

E. Information significant to use for septic fields.

F. Information significant to suitability as a base for building foundations.

G. Information significant to use for recreation and wildlife.

IX. List of important information that is not available and for which plans should be made to collect.

X. References and bibliography.

A. Sources and availability of data.

B. Short abstract of unpublished material.

This is a guide and should be used accordingly. If information is not available for an item, it is not expected that you will collect samples, run laboratory analysis, etc. If information is available that is not suggested in the outline, it is assumed that you will include it if it is of value. Basic data should be clearly separated from interpretations in assemblying benchmark materials.

The national committee noted that continual attention needs to be given to the soil units for which interpretive data and estimates are assembled. In most soil survey areas, interpretations are made for soil mapping units or for the components of complexes. A few interpretations can be made for soil series; e.g., to some extent for water-holding capacity, plant nutrients, and some engineering properties. When data are assembled for benchmark soils, descriptions of the soils should be obtained so the relation to correlated mapping units will be clear. Capability groupings and other groupings should be made for actual soil mapping units or for units likely to be named. Soil mapping units should be listed by name whenever practical. Listing will encourage adequate descriptions and interpretations of mapping units in soils handbooks and soil survey reports.

The matter of whether or not interpretive material should be included in a report of this kind was discussed by the national committee. Some felt that only basic data for characterization and field results should be assembled for the benchmark soil, whereas others felt that interpretations, as yield predictions, crop suitabilities, and soil and water management practices, should be made. Perhaps the conference can help in deciding how far we should go into interpretations.

In areas where the soil survey will not be completed for a long time, the national committee recommends that extensive soil series be selected, their names be properly ascertained, and characterization data and interpretive predictions be made.

The committee further recommends that it be continued, so as to function as a coordinating body for this project.

Comments

Dr. Aandahl. There should be a place for predictions in this benchmark project. Those working on benchmark response data should analyze it (not necessarily statistical analysis) and carefully evaluate it, so as to make useful predictions. Yield predictions are nothing more than putting principles (measured data, plus physical and chemical evaluations) into figures.

Dr. Kellogg. As I recall, the benchmark idea was first mentioned as a means of collecting data from observations of soils being used for growing crops, for the purpose of applying it to similar soils in other areas for which little or no data is available. By setting up benchmarks for correlation and interpretation, there would be benchmarks from which to expand basic information for other soils in the county from which to elaborate interpretations.

Mr. Johnson. Should not the outline call for evaluating soil qualities? It was agreed that it should.

Mr. Klingebiel. In selecting data for a benchmark document, should these data be only for the central concept or should they cover the range of the soil? I want to direct attention here to the desirability of presenting the data for mapping units rather than for the type or series as a whole. There are notable differences among the mapping units of a series in their responses to management. If these data are given according to mapping units, the question of having them for the central concept or the range is a less serious problem.

Dr. Kellogg. Are there plans for publishing these benchmark data?

Mr. Edwards. None.

Dr. Kellogg. Although these data very likely should be given for mapping units, the project should be kept broad enough to cover the whole series. For example, do not emphasize A and B slopes at the expense of the other slope phases.

Committee Members:

*Max J. Edwards, Chairman
*W. H. Bender
M. T. Beatty
*B. D. Blakely
*Ray W. Chapin
H. C. Dean
*Louis E. Derr
R. W. Eikleberry
L. E. Garland
Joel E. Giddens
*A. A. Klingebiel
C. J. Koch
J. W. Metcalf
H. Howe Morse
R. T. Odell
S. S. Obenshain
F. T. Ritchie
A. S. Robertson
*Val W. Silkett
*J. D. Simpson
Warren A. Starr
*J. Gordon Steele
J. C. F. Tedrow
Rudolph Ulrich
L. R. Wohletz

*Those who participated in committee meetings at the St. Louis Conference.

Others attending the committee session:

W. H. Allaway
Charles E. Kellogg
F. G. Renner
J. L. Retzer

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of Committee on Soil Moisture

The objective of this Committee, during the past year, was to continue the development and definition of terms and classes for the description and evaluation of moisture relations in soils. We also had to consider the suggestions made by the Regional Committees in response to the 1957 report of this Committee.

Your Chairman was contacted by Mr. Tyler Quackenbush regarding the class intervals for available moisture. It was his opinion that to be useful to engineers the class intervals must be less than twofold. It was the opinion of your Committee that we do not know enough about the measurement of available water and the precision of its measurement to substantiate the reliable use of the class intervals in our last report. These involve twofold ranges as a maximum. Further, your Committee feels that there is no sound basis for the detailed estimates contained in many of the irrigation guides that have been prepared with Service help and blessing. We hope that work now underway and that contemplated will improve our knowledge in this subject matter field.

The Committee then turned its attention to the reports from the various Regional Work-Planning Conferences.

Definition of Water Table

The Northeastern and Western Regional Committees had no suggestions for improvement of the definitions presented by the 1957 Committee Report. As the result of a suggestion by Dr. C. B. Tanner, the North Central Regional Work-Planning Conference agreed on the following definition of water table:

> "The water table is the loci of points in the soil at which the hydraulic pressure is equal to the atmospheric pressure. This appears in an observation well as the surface of standing water at equilibrium."

The North Central statement differs from the 1957 National Report in that it recognizes the water table as being the loci of points in a soil rather than in soil water. Your Committee agrees with this position of the North Central Committee. We do not agree with the second portion of the North Central definition because we propose to include zones of moving water in the definition.

The revised definition presented for your consideration is as follows:

> "Water table - The upper surface of the body of free water which completely fills all openings in material sufficiently

pervious to permit percolation. This is the loci of points in soil at which the hydraulic pressure is equal to the atmospheric pressure."

There were no suggestions for changes in the 1957 definition of perched water table.

Kinds of Water Zones

Comments from the North Central and Western Regional Technical Work-Planning Conferences indicated that there is some need for clarification and justification of the three kinds of water zones described in the 1957 National Report.

1. Continuous water zones, those which are thick, continuous to impervious rock, persist the year round, and lack dissolved oxygen. These zones make their mark by gleying or mottling the soil and by furnishing an environment unsuitable for root growth.

2. Perched water zones, those which are thin, lack dissolved oxygen and are not present the year round. These are similar to 1. in effect on both soils and plants but not necessarily to the same degree. They are discontinuous with respect to time.

3. Aerated water zones, either continuous or perched, in which the water moves down slope and contains dissolved oxygen. This zone perhaps needs the most explanation. The conditions existing in this kind of zone do not bring about mottling or gleying and they do not inhibit root growth. Soils such as the Ahmeek have these oxygen containing moving water zones at some times during the year. One finds unusually well developed mats of fibrous plant roots in the water zone and there are no evidences of mottling or gleying. Evidence of the movement of the water zone can often be recognized by noting the entry of water from the uphill side of a pit and outflow on the lower side.

At this point, it should be re-emphasized that character, position and duration of the water table should not be regarded as soil characteristics that are determinative in soil classification. They are of importance in classification only to the extent that they have had an influence on the properties of the soil that do determine the classification.

Classes for Depth to Water Table

Both the North Central and the Northeastern Committees suggested an additional class for standing water. Your Committee agrees with this suggestion.

Mr. Templin suggested the need for a class of depth to water table in the range of 5 to 10 feet, particularly for forestry uses. Dr. Rust found that some of the highway people were interested in noting depths greater than 5 feet also. Your Committee agrees with this suggestion and suggests the following revised classes:

Depth of Soil to Water Table

Standing Water	
0 - 10 inches	very shallow
10 - 20 inches	shallow
20 - 40 inches	moderately shallow
40 - 80 inches	moderately deep
80 - 160 inches	deep
*(160 - 320 inches (((no water table within 320 inches	very deep

The Committee does not accept the recommendation of the Northeastern Committee that a water table close to the surface be designated as "very high". We prefer to think in terms of the depth of soil to the water table. This usage is consistent with our soil depth terminology. The Committee also voted not to accept the recommendation of the North Central Committee that no names be given to the classes. It was felt that the use of names could not be prevented and, hence, a better policy would be to assign names for sake of uniformity in usage. The Committee recognizes the fact that the 0 - 10 inch class may be too broad for Northern or Southern soils. This class may have to be broken up for local use in Alaska, for example.

The Committee suggested the names for the depth of soil to water table classes indicated in the table. However, the Conference was unable to agree that these names would be uniformly significant in the various parts of the United States. No satisfactory substitutes were developed.

Limits of Water Table Fluctuation

The Northeastern Committee recommended that no attempt be made to estimate the limits of water table fluctuations. The Committee agrees that attention for the present should be focused primarily on the upper limit of the water table.

*added by discussion in whole Conference

Duration Classes of Water Tables

There was no disagreement with the 1957 National Committee's suggestion on duration classes. However, the Western Committee recommended that particular attention be paid to the season of the year when the water table exists in the soil. Your Committee agrees with this point of emphasis.

Aeration

The North Central Committee suggested that "aeration" was not an appropriate concept because the classes are inferences based on interpretations of observations of colors, landscapes and positions among other things. Rather, they thought that we should report what we see. They raised a question as to whether this makes a national classification of "drainage" impossible. They then proposed a series of "wetness" classes as an attempt to improve the situation. They suggest:

no evidence of wetness	rarely wet	nearly always dry
very little evidence	seldom wet	very often dry
little evidence	often wet	often dry
much evidence	very often wet	seldom dry
very much evidence	nearly always wet	rarely dry

To your Chairman, at least, these classes are not free from the "inference" taint mentioned by the North Central Committee.

Our old drainage classes, as recognized mainly by degree of mottling or gleying, encompassed all that we could see or infer about the "wetness" of the soil It took into consideration the effect of position, duration and season of the water table and, for good measure, tossed in the internal characteristics of the soil itself, such as, rate of movement of water or hydraulic conductivity.

Your Committee, during the last two years, has made an attempt to set up better observational "sky hooks" for recording soil observations by noting the position, duration and season of the water table, by noting the internal characteristics of the soil as evidenced by its degree of aeration and by measuring or inferring the rate of water movement or hydraulic conductivity. That we have not had complete success is evidenced by the fact that the Committee members cannot, at this moment, agree upon any common philosophy with regard to the aeration classes as recommended by the 1957 National Committee. Further thinking on the subject of aeration is an obvious unfinished task of this Committee.

Permeability

At the suggestion of the North Central and Northeastern Committees, consideration was given to the need for a permeability or hydraulic conductivity class

to separate the essentially impermeable material from the very slowly permeable ones that may support a good agriculture. Your Committee agrees with the position of these two Regional Committees and recommends a revised set of permeability or hydraulic conductivity classes, as follows:

$<$ 0.063 inches/hour

0.063 to .020 inches/hour

.63 to 2.0 inches/hour

2.0 to 6.3 inches/hour

$>$ 6.3 inches/hour

The suggestion of the North Central Committee with regard to soil moisture climate relationships was referred to Dr. Hutching's Committee on this subject.

Your Committee still has not given consideration to the question of runoff classes. There is some thought that these should be considered interpretative groupings.

During the coming year, limited facilities for soil moisture work in the Soil Survey Laboratories will be aimed at getting more information on the correspondence between moisture retention values of disturbed and undisturbed samples and on the validity of the moisture availability values in relation to crop growth. Cooperation with some of the State Experiment Stations will be arranged where a combination of effort will be advantageous.

It is suggested that the members of this Conference take advantage of any opportunities they have to urge engineers of the Service or the State Experiment Stations to measure field water intake rates on soils of well-defined series and type and that the time or position in the crop rotation be noted. The most desirable points in a cropping system for measuring water intake rates are when the soil will take water at the fastest and the slowest rates. These will likely correspond to the ends of the hay or pasture crop and to the clean cultivated crops respectively.

The Committee should be continued in order to complete unfinished business indicated in the body of this report and for the purpose of carrying out any additional tasks assigned to it by the Conferences.

<u>Committee Members</u>:

*L. T. Alexander, Chairman	C. J. Francis	*A. C. Orvedal	F. W. Schroer
*J. S. Allen	M. F. Hershberger	B. J. Patton	*G. D. Smith
*T. C. Bass	*T. B. Hutchings	Samuel Reiger	*D. W. Swanson
G. L. Barger	Wendell Johnson	O. C. Rogers	*H. P. Ulrich
*A. J. Baur	Lester Lawhon	R. V. Ruhe	J. M. Williams
R. R. Bruce	H. J. Maker	*R. H. Rust	*J. H. Winsor
*J. E. Dawson	A. P. Nelson		

*Those who participated in committee meetings at the St. Louis Conference.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of Committee on Improving Soil Survey Procedures

The committee on Improving Soil Survey Procedures is a new one, meeting this year for the first time. It was organized, following last year's national conference, in response to requests from several sources.

Statement of Chairman

The need to accelerate soil survey work continues to be most pressing. Soil surveys are now in greater demand and are being used more widely than ever before. Although the number of soil scientists engaged in mapping has been significantly increased in recent years and the area being mapped each year is increasing, the progress of soil survey work still lags appreciably behind demands, and even behind our own estimates of what we should be accomplishing.

It is urgent that all of the available resources for soil survey work be utilized most effectively. There is reason to believe that the amount of soil survey work now being accomplished annually could be increased significantly, perhaps even by as much as 15 percent to 20 percent or more, without increasing the present staff of soil scientists.

Striving for increased production of high quality soil surveys is an important part of every soil scientists job. It is part of our jobs to scrutinize carefully the procedures we are using in the conduct of soil surveys and to be on the alert constantly for ways and means of effecting improvements, both as to quality of the work and quantity of production. The more effective use of only a few minutes of time daily by each soil scientist could result in several thousand additional acres being mapped yearly. But good quality of work must not be sacrificed merely to accomplish increased production.

Too often, I believe, we have been inclined to relegate into the background the part of our jobs having to do with increasing production. Our usual premise has been that matters of this kind are for the concern only of the administrative or "line" supervisor and that soil scientists, as "staff" employees, need concern themselves only with the quality aspects of the job. This, I assure you, is faulty reasoning. To be sure, our administrative supervisors are deeply interested in the production phases of the job. It is true also, that putting improvements into effect often requires administrative action. This, however, does not relieve us of our responsibilities to recommend improvements whenever we see the need for them. We should bear in mind, too, that line officers also are concerned with the quality aspects of the work. Increasing the efficiency of soil survey work is a job requiring the best cooperative efforts of both line and staff. It is in this light that the Committee on Improving Soil Survey Procedures has operated. Where recommendations are made which involve the administrative aspects of the work the recommendations of the committee are presented for consideration by appropriate line officers.

Objective of Committee

To recommend improvements in the procedures and techniques for conducting soil surveys, for purposes of accomplishing either increased production or improved quality, or both.

Committee Considerations

Committees on Improving Soil Survey Procedures met this year at the regional soil survey conferences for the North Central States and for the Western States. The reports from these two conferences were reviewed by the national committee prior to this conference. In addition, the Committee also reviewed the recommendations contained in the report of the 1957 national conference committee on Improving Soil Correlation Procedures, and a number of other statements, some of which were in the form of memoranda, containing comments and suggestions relative to increasing efficiency of soil survey work. These materials served as the basis for the Committee's discussion at this conference.

In recognition of the limited time available for discussion at this conference and also of the desirability of being as specific as possible, the Committee decided to restrict its discussions this year to the following four broad fields:

I. Use of time of soil scientists engaged in field mapping operations.

II. Coordination of various soil survey activities.

III. Training of soil scientists.

IV. Soil survey equipment and materials.

Committee Recommendations

I. Use of Soil Scientist Time: Existing records indicate that on a national basis in 1957 about 56 percent of the time of Service-employed soil scientists engaged in field mapping (grades GS-5, GS-7, and GS-9) was spent on soil survey work. Of the total time of these soil scientists about 43 percent was spent on field mapping and about 13 percent on other soil survey activities, including legend preparation and interpretations. The Committee believes that improvement can be made in this regard and recommends:

A. That steps be taken by appropriate administrative officers to assure that soil scientists spend a maximum amount of their time on soil survey and other work requiring the services of professional soil scientists. The following time distribution is suggested as being a reasonable average for soil scientists performing field mapping:

Soil mapping activities - - - - - - - -	55%
Other soil survey activities- - - - - -	15%
Other soil scientist work - - - - - - -	10%
Other activities, including leave - - -	20%

B. That a concerted effort be made, wherever practicable, to increase the number of standard surveys on which mapping is being done on a progressive basis. It is suggested that, in those areas where two or more soil scientists are engaged in field mapping, consideration be given to the practicability of assigning necessary individual farm survey jobs to a restricted number of the soil scientists, thus releasing others for progressive mapping.

C. That in areas where individual farm surveys are necessary, the requests for such surveys be carefully "screened" to accomplish either, or both, of the following objectives:

1. Elimination of requests where the immediate need for the farm survey no longer exists.

2. Selection of several adjacent farms to be mapped progressively on a block basis.

D. That local area and work unit conservationists, county extension agents, and others, give increased emphasis to information and other public relations activities relative to soil survey work in their areas, thus relieving the soil scientist of this important, but time-consuming task. Such public relations should include:

1. Informing farmers and ranchers in advance about the soil survey so they will understand what the soil scientist is doing when walking over their lands.

2. Keeping farmers and ranchers advised of the progress being made on the survey.

3. Obtaining necessary clearances in advance for mapping, digging of test pits, collection of samples, use of power-driven equipment, etc.

E. That possibilities for seasonal assignments of soil scientists within States and between States be explored by appropriate administrative officers, and that such assignments be made wherever they would result in more efficient use of the soil scientists time.

II. <u>Coordination of Soil Survey Activities</u>: The lack of adequate coordination or synchronization of the various phases of the soil survey job has created serious problems affecting efficiency of the work. Evidences of this lack of coordination are: (1) necessary postponements or delays of a number of field reviews and soil correlations because either the field work was not completed in accordance with schedules or necessary information such as soil descriptions, legends, acreage estimates, etc. was inadequate or lacking altogether; (2) delays that have been necessary in the editing of several

soil survey reports, either because the reports had not been submitted when scheduled, or because one or more of the steps in soil correlation had not been completed; and (3) the final preparation of maps in the cartographic laboratories has been impeded because one or more of the necessary prerequisite phases had not been finished. The Committee recognizes the necessity for a high degree of synchronization among the several steps of the complete soil survey and recommends the following:

A. That the Service, particularly individuals in administrative or "line" positions, continue to strive for an improved understanding by all concerned of the Service objectives, both immediate and long-time, with respect to soil survey work.

B. That soil correlators and State soil scientists allow sufficient flexibility in their time schedules to permit reasonable adjustments as may be needed to take care of jobs unavoidably delayed beyond scheduled completion dates.

C. That, wherever practicable, the field and intermediate correlations, or the intermediate and final correlations, or all three steps in correlation be combined in one operation.

D. That, insofar as possible, decisions relative to feasibility of phase separations be made during or prior to the final field review and field correlation. (The Committee could not endorse the suggestion that the correlation staff limit its considerations to the soil series and type level.)

E. That a copy of the up-to-date descriptive legend for a soil survey area be incorporated as part of the report of the final field review and field correlation for the area. This will aid materially in expediting intermediate and final soil correlations.

F. The Committee strongly endorses the statement on Preparations for Field Reviews and Correlations contained in the report of the 1957 national committee on Improving Soil Correlation Procedures. This statement has been reproduced and is attached as a supplement. The Committee recommends that the State Soil Scientist or other appropriate technical supervisor supply to each Survey Party Leader in his State, a copy of this, or a similar locally-prepared statement, to serve as a check-list in preparing for final field reviews and field correlations. Such statements or check-lists should be provided to the Party Leaders at the beginning of the surveys or as soon thereafter as practicable.

G. The Committee recommends that increased use be made of existing procedures for prior correlation of tentative soil series. These procedures are described in Soil Survey Memorandum No. 10 but have not been utilized to any great extent to date. It is recommended also that

field soil scientists be encouraged to participate more widely in the preparation of first drafts of new and revised official national descriptions of soil series.

H. The Committee believes that the Standard Soil Survey Flow Charts developed in the Western States under the guidance of W. M. Johnson, if utilized in scheduling soil survey work, would be a distinct aid in achieving a needed higher degree of synchronization of the individual soil survey activities. It is recommended that each State Conservationist be supplied with copies of these charts for distribution to Area Conservationists and to representatives of other agencies participating in the National Cooperative Soil Survey.

III. Training of Soil Scientists: The Committee recommends the following with regard to training both new and experienced soil scientists:

A. That SCS develop and adopt a program for encouraging details and transfers of soil scientists among States for purposes of broadening their experience. This program should include provisions for those soil scientists in grades GS-7 and GS-9 who have shown a potential for advancement to more responsible positions in soil survey work. It is recommended also, in those cases where there is hesitancy on the part of one State to accept a relatively unknown soil scientist by transfer from another State, that a short detail of the soil scientist to the State in question be arranged. It is believed that in many cases this type of arrangement would prove very helpful to both the State Office and to the soil scientist.

B. As part of the program to encourage inter-State transfers of soil scientists, it is recommended that an article or series of articles be included in Soil Survey Field Letters pointing out the advantages to be gained, and also possible personal sacrifices that sometimes have to be made, in accepting transfers of this nature.

C. That encouragement be given to soil scientists, particularly those headquartered in rather isolated locations and who are interested in self-improvement, to explore possibilities of taking desired courses by correspondence from the university or accredited colleges in the State, or from the USDA Graduate School.

D. That each State Office, not now having them, explore the possibility of purchasing a limited number of good technical reference books on soil science and related subjects. Such books then could be made available to soil scientists on a loan basis for periods longer than the usual loan period on books secured from libraries. The latter often are too short to permit detailed study.

E. That the Soil Survey Laboratory staff, in cooperation with appropriate representatives of the State Experiment Stations and other agencies, prepare written guides on the interpretation of laboratory data in terms of significance to soil genesis and soil behavior. These guides should be designed primarily as aids to soil scientists engaged in field survey operations.

F. The Committee strongly endorses the Student Trainee program as a highly desirable means of recruiting and training soil scientists and recommends that continued emphasis and encouragement be given to this program. It is recommended that soil survey leaders in the State agricultural colleges be supplied with complete information about the Student Trainee program in order that they may be in a better position to interest more students in accepting student trainee jobs and by this means to encourage more students to specialize in soils.

G. That, in the use of Student Trainees in soil survey work, emphasis be given to the training aspects of the job and that, at least for the first full field season for a Student Trainee, production be considered only as a secondary or incidental objective. The Committee recommends also that wherever possible Student Trainees in Soils be assigned to survey parties conducting progressive standard surveys.

IV. Soil Survey Equipment and Materials: The use of modern, up-to-date and, in a number of cases, newly-devised equipment and materials has resulted in appreciable time being saved in the conduct of soil survey field work and, in some cases, improved quality of the work. The Committee has the following recommendations:

A. There are indications that the use of color aerial photographs as base maps for soil survey mapping in certain locations may have distinct advantages which would more than offset the significantly higher cost of such photographs. It is recommended that the Cartographic Division of SCS explore the possibility of conducting, in cooperation with a State Office, a trial on a carefully selected small area of 25 to 30 square miles to determine the possible advantages of using color photographs and under what conditions use of these materials might prove feasible.

B. It is recommended that the results of the trial now being made in Minnesota on the use of special aerial photography in soil survey mapping be thoroughly analyzed and circulated to all States. Briefly, this trial consists of the use of especially flown aerial photography in a selected area of several townships in Minnesota. The Soil Conservation Service arranged for a special flight to be made at a time when the ground was free from snow and prior to any considerable growth of spring seeded grain, and when soil and water conditions were such as to bring out maximum contrast between the soils. Scale of the photography was 1:15,840 and 1:31,680. Contact prints were made with a Logetronic

printer. It is anticipated that the use of this special photography may result in increased mapping rates together with better quality of soil survey work. Cost of the special aerial photography will be an important factor in evaluating the advantages, if any, of using these photographs.

C. The Committee believes that modern methods of aerial photo interpretation could be utilized more effectively in the conduct of soil surveys in many areas. It is recommended that the adequacy of the aerial photographs being used for soil surveys in each survey area be appraised under the direction of the appropriate State Conservationist with the view in mind of replacing outmoded or otherwise inadequate photographs with more usable ones. It is recommended also that each soil scientist be given training in photo interpretation. Stereoscopes should be made available wherever such equipment can be utilized effectively.

D. That State Soil Scientists and others investigate the possibilities within their areas of utilizing back-hoes and other types of power-driven equipment for the excavation and filling of soil test pits, both in connection with observing and describing soil profiles during soil surveys and in determining suitability of soil materials for earth structures. It is recommended also, that the Washington Office of SCS secure appraisals of the advantages and limitations in the use of this type of equipment from the few States where it has been employed in soils work to date, and that this information be generally distributed to all States. Particular attention should be given in the appraisals to advantages and disadvantages of owning versus renting such equipment.

This concludes the recommendations of the Committee at this conference. The Committee believes that it has by no means considered all phases of soil survey work in which opportunities for improvement exist, nor has it completely covered the four phases of the job discussed in this report. It is therefore recommended that the Committee be continued.

Committee Members:

*R. D. Headley, Chairman
*A. R. Aandahl
H. H. Bailey
W. J. B. Boatman
W. W. Carpenter
*D. R. Cawlfield
*D. R. Gardner
W. W. Hill
*W. M. Johnson
*W. S. Ligon
*F. M. Orsini
*A. H. Paschall
*Forrest Steele
R. E. Storie
*H. B. Vanderford
F. C. Westin

*Those who participated in committee meetings at the St. Louis Conference.

Discussion

Silkett: What distribution is made of the report of this committee?

Hockensmith: The final report of each committee and of the individual presentations given at the conference are reproduced in the Washington Office, are assembled in complete sets, and then are distributed to the State Conservationists who, in turn, distribute them to others in the Service, to the State Experiment Station soil survey leaders, and to representatives of other agencies in the State who are cooperating in soil survey work. This year it is our plan to discuss the material in the report of this committee at the Operations Planning Conferences this fall and at a number of statewide meetings of area conservationists.

Silkett: I recommend that the statements and recommendations of this committee that deal with operations management be prepared in a separate report for the State Conservationists and Operation Management Leaders.

Kellogg: I think we can do that.

Hockensmith: I recommend that the work of this committee be officially enlarged to include the work formerly carried on by the committee on Improving Soil Correlation Procedures. (The conference agreed.)

Kellogg: What are the wishes of the conference as to the acceptance of this committee's report and to the recommendation that the committee be continued? (The report was accepted and continuation of the committee was approved.)

Excerpt from the committee report on "Improving Soil Correlation Procedure" given at the 1957 National Technical Work-Planning Conference of the Cooperative Soil Survey:

Preparations for Field Reviews and Correlations

It is doubtful if a party chief has ever been fully ready for the final field review and field correlation. Furthermore, it is doubtful if many of them realize how much they are not only permitted to do by are expected to do in preparing for field reviews. Preparations for the final field review and field correlation normally include the following:

1. Complete list and description of all mapping units.

2. Complete list of all symbols with definitions.

3. Acreage measurement of each soil mapping unit.

   A knowledge of the extent of each mapping unit is essential for correlation. A record should be kept of the location and acreage of each mapping unit until a minimum acreage has been mapped. It is difficult to establish the necessary minimum, but if we assume that acreage measurements for the report will be obtained by a sampling procedure, 1,000 acres seems a reasonable figure. Also, complete measurements should be made of those soils which occur in only a few areas but which may occupy several thousand acres.

4. Color checking of all sheets for:

   a. Areas without symbols.

   b. Two or more different symbols within any area.

   c. Open boundaries.

   d. Inaccurate joining of sheets.

   e. Legibility.

5. Routine road check.

   The concepts of many mapping units are subject to evolution during the survey, and a routine check of the field sheets from the roads will locate many errors.

6. Laboratory data of samples are available. Plans for necessary laboratory analysis should be made early in the survey in order that the results can be available at the time of the field correlation, and even better, during the survey field work.

7. Correlation samples collected.

8. Soil association map of the county prepared.

9. First approximation of field correlation prepared by Party Chief. He should be able to explain and defend his first approximation. Although this first approximation might not agree completely with the field correlation, the Party Chief should have good reasons for his recommendation.

Preparations for a comprehensive progress field review near the end of a survey would include many of the items mentioned for the final review.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Committee on Soil Horizon Nomenclature

The 1958 Committee on Soil Horizons was charged with testing the proposals contained in the 1957 committee report, calling upon correlators, State soil scientists, Experiment Station workers, and at least a few field soil scientists for independent trials. Trials were reported during the year by 12 committee members and included tests by at least 3 individuals of each of the groups mentioned above.

Tests by most field soil scientists revealed considerable misunderstanding of definition or intent of designations proposed by the 1957 committee, and except in one case, were not particularly significant as means of evaluating merits of the proposals. They did indicate that considerable difficulty can be anticipated in obtaining consistent application by a high proportion of field scientists. To a high degree, failure to read carefully the 1957 report was responsible for failure. It was noted that application of the manual definitions was almost equally faulty, however.

The trials also revealed a number of faulty definitions in the 1957 proposal as well as sharp disagreement over specific proposals and cases in which horizons either could not be classified or could be classified in either of two ways.

Committees of the Southern, Western, and Northeastern Technical Work-Planning Conferences were active during the year. That of the Northeastern States confined its activities to a work-shop on use of the designations proposed by the 1957 committee and made no recommendations to the national committee.

The committee of the Southern Conference recommended the following modifications of the 1957 National Committee Report:

(1) That master horizon A be defined to include Manual A_1 and A_2, Symbols A, Ah, or Ap to be used for Manual A_1 and Ae for Manual A_2. The committee objected emphatically to obligatory use of "h" with A and to subdivision of Manual A into two master horizons A and E as proposed in 1957.

(2) That master horizon E be used for the eluviated horizon above the claypan of Planosols or above fragipans. It was stated that proposals 1 and 2 above would not alter the meaning nor interfere with the use of E as defined for the 6th Approximation, the inference being that the definition of E should correspond with that of the 6th Approximation, possibly with restriction on use with associated horizons.

(3) That "g" and "gg" be used to indicate two degrees of gleying.

The report covered only items of the 1957 National report on which there was not agreement among regional committee members present.

The committee of the Western conference made the following recommendations relative to the report of the 1957 National Committee:

(1) Endorsed use of arabic numerals solely for vertical order
(2) Endorsed avoidance of degree of expression as criteria
(3) Endorsed elimination of position as a criterion except for A
(4) Endorsed establishment of master horizon O
(5) Endorsed definition of A in principle (but with some reservations due to problems of arid regions)
(6) Endorsed establishment of E to replace A2
(7) Recommended definition of B as the aggregate of the kinds of B proposed in the 1957 report and endorsed recognition of those kinds
(8) Endorsed recognition of "S", "L", and "R" as master horizons
(9) Endorsed dropping "G"
(10) Endorsed use of Roman numerals only for horizons of the solum
(11) Recommended alternatives for C, D, and F as proposed in the 1957 report, involving:
   a) redefinition of C to allow for induration, as by $CaCO_3$
   b) recognition of Cj for non-indurated C in which alkali is not concentrated
   c) recognition for Cak for C in which alkali is concentrated
   d) use of conventional ca, cs, sa with C
   e) use of Cx for fragipans
   f) redefinition of D to allow for cementation and addition of soluble materials

The Western Conference, however, rejected items 5 and 10 above. It recommended that Roman numerals be applied not only to the solum but also to underlying material to indicate discontinuities, thus eliminating D and Ru as proposed by the 1957 committee. It left the question of A unresolved as applied to soils of arid regions.

Following receipt of the results of tests of the 1957 proposals and of the regional committee reports, a summary and questions regarding specific problems were circulated to all National Committee members, and their replies were incorporated into a tentative committee report. This was sent to members 1 week prior to the national meeting with specific requests for alternative definitions or solutions to problems within the week. Members at the national meeting spent the allotted time and an additional one-quarter day on the tentative report but were unable to complete its revision. The recommendations that follow as a result of this work call mainly for further consideration of controversial proposals; thus, this report implies continuation of the committee.

The most significant feature of the committee meeting at St. Louis was a nearly universal sentiment for return more nearly to Manual concepts. This sentiment is reflected in the recommendations that follow.

Recommendations

A. Specific proposals to be adopted by the Cooperative Soil Survey as official conventions:

1. That master horizon O and subclasses as defined below be adopted as official conventions.

   O - Organic horizons of mineral soils. - Organic horizons formed or forming in the uppermost part of soils classified as mineral soils. O horizons are dominated by fresh or partly decomposed organic matter and contain more than 30 percent organic matter if the mineral fraction has loamy or clayey texture or more than 20 percent organic matter if the mineral fraction has loamy sand or coarser texture. Three subclasses, Od, Of, and Oh may be recognized, but their use is not obligatory.

   Od - Litter horizon - Relatively undecomposed vegetative matter retaining essentially original vegetative form, either essentially unaltered or discolored and leached of some mineral constituents. Remains of soil fauna may be present. Od corresponds to the "L layer" of Forest Soils literature and part of A_{oo} of the Soil Survey Manual.

   Of - "Decomposition" horizon - Partially decomposed vegetative matter still mainly recognizable as to origin without magnification but in the process of disintegration. Remains of soil fauna are generally present and the horizon is commonly filled with fungal hyphae. The material may be loose, laminated, or fibrous. The symbol Of corresponds to the "F layer" of Forest Soils literature and is normally included in A_{oo} of the Soil Survey Manual.

   Oh - Humus horizon - Organic material mostly unrecognizable as to vegetative origin though remains of parts of plants or animals may be identified with magnification. Excrement of soil fauna is commonly a large part of the material present. "Oh" corresponds to the "H layer" of Forest Soils literature and is included in Ao of the Soil Survey Manual.

2. That requirements for "outstanding concentration" be removed from definition of subclasses "t" and "ir" of master horizon B of the Soil Survey Manual. This recommendation in no way prejudices future action on definition of B or of its subclasses.

3. That arabic numerals and lower case letters used in conjunction with master horizon designations be on the same line as the master designation, (not subscripts).

B. For consideration and testing but not for adoption or general release to field soil scientists.

1. A and E horizons proposed by the 1957 committee

The Western Committee endorsed use of A and E in principle as it affects separation of Manual A_1 and A_2 but was unable to accept Ah as defined for soils of arid regions. The Southern Committee rejected separation of Manual A_1 and A_2 and objected to obligatory use of h with A. Many individuals were confused by Ah in relation to Ap. Several committee members favored modifications of the Southern Committee's recommendation. At the committee meeting in St. Louis, there was argument to include Manual A_1 and A_2 in the upper part of the soil as parts of master horizon A and to recognize E for other eluviated horizons below the zone of maximum biological activity or without an underlying and related B. Time did not permit thorough consideration of definitions, but the following are proposed for trial:

<u>A Master horizon</u> - A mineral horizon formed or forming at or adjacent to the surface within the zone subject to the most direct influences of the external environment and of plant and animal life. The Master A horizon includes (1) horizons in which organic matter accumulated from plant and animal residues without illuviation from another horizon are mixed with and darken mineral matter, either with or without eluviation of silicate clays or oxides of iron or aluminum, (2) eluvial horizons that have lost silicate clays, iron, or aluminum with resultant concentration of resistant minerals of silt and sand size, that are associated with a genetically related horizon of illuviation of silicate clay, iron, aluminum, or humus, and that may or may not be darkened by accumulated organic matter, and (3) plowed or similarly mixed surface horizons in material presumed to have been part of any horizon or layer prior to mixing. Subclasses of master horizon A include Ah, Ae, Aeh, and Ap as defined below:

Ah - An horizon that meets the requirements of master horizon A, that has measurably more organic matter than a C horizon if present, that is undisturbed by plowing or similar mixing, and that has not lost clay, iron, or aluminum relative to an underlying B. It is usually darker than the C horizon and as dark as or darker than a B horizon that directly underlies it. It has coatings of organic matter or mineral particles or is darkened by organic matter. Ah is an uneluviated horizon (except for loss of materials more soluble than dolomite in pure water) of residual organic matter accumulation in a mineral matrix unaltered by plowing or similar mixing.

Ae - An horizon that meets the requirements of master horizon A, that has lost clay, iron, or aluminum relative to an underlying B with resultant concentration of resistant minerals of sand or silt size, that is measurably lower in organic matter than an overlying Ah or Aeh if present, and that is undisturbed by plowing or similar mixing. It is usually lighter in color than an underlying B or the particles are free enough of coatings that the color is determined by that of sand and silt particles. It may underlie Ah, Aeh, Ap, or O horizons and always overlies a B.

Aeh - An horizon that meets requirements of master horizon A, that has lost clay, iron or aluminum relative to an underlying B with resultant concentration of resistant minerals of sand or silt size, that is darkened by organic matter, and that is undisturbed by plowing or similar mixing. It represents an eluviated horizon in which organic matter is concentrated. It must be measurably higher in organic matter than an underlying Ae if present. It may or may not overlie an Ae horizon and must be associated with a related B horizon.

Ap - A plowed or similarly mixed surface horizon. The lower case letter p indicates disturbance by plowing or similar mixing. It may or may not include material other than that of an original A. Plowed layers entirely within a former B, C, or other horizons are to be designated as Ap on the grounds that they represent the zone of maximum biological activity and, in effect, a zone in which new soil development characteristic of A is dominant.

<u>E Master Horizon</u> - An eluviated mineral soil horizon not associated with an underlying B. It has lost clay, iron, or aluminum relative to an underlying related horizon. It is usually either lighter in color than an underlying related horizon or its particles of silt and sand size are free enough of coatings that they determine the color of the horizon. It commonly overlies horizons comparable to fragipans. It may or may not have an underlying genetic horizon.

2. <u>B horizons</u>. There were almost as many different ideas in detail as there were persons concerned with evaluation of the 1957 proposal. A substantial number preferred inclusion of fragipans as kinds of B. At least 3 would confine B to illuvial horizons. Several would exclude "color B" from B. Several would include sesquiozide horizon in B. A substantial number, including most committee members at the conference wanted to retain structural B. One would include L with Bfe using arrows to indicate direction of water movement. The 1957 proposals

for kinds of B were accepted by the Western Committee without alteration; the Southern Committee did not comment directly. There was agreement generally that definition of master B must be broad enough to encompass more than the kinds of B recommended by the 1957 committee.

The committee members at St. Louis agreed to propose a master B horizon that would add a structural B to the list proposed in 1957 and would drop anthropic B as a special kind, on the assumption it could be classified among the other kinds enumerated. It was mentioned that there is not agreement in Europe of a need for recognition of this special kind. The committee could suggest no method of definition of master B other than by enumeration in the time at its disposal. Tentative definitions of master B and its parts follow:

B Master horizon - A genetic horizon formed or forming within the zone of substantial biological activity within which silicate clay, iron, or aluminum, alone or in combination and with or without humus, has been concentrated, (2) humus has accumulated by illuviation, or (3) maximum color or prismatic or blocky structure has developed, consistent with definitions of subclasses that follow:

Bt - Textural B is an horizon in which silicate clay has been concentrated but which lacks brittleness characteristic of fragipans. In soils formed from parent materials without lithologic discontinuities, it is an horizon of maximum silicate clay content, showing clay skins in some pores and on at least some of the vertical and horizontal ped surfaces if the structure is blocky. If the soil is structureless, the clay skins must be present in some pores, but the clay may be present chiefly as coatings on individual sand grains and as bridges connecting the grains. Where an A is present, and in the absence of a lithologic discontinuity, if the A contains less than 15 percent of clay, the B must in some part contain 3 percent more clay than the A, as computed on the basis of the total soil mass. If the A contains between 15 and 40 percent clay, the ratio of clay in the B to the clay in the A must be 1.2 or more. If the A contains over 40 percent clay, the B must contain at least 8 percent more clay than the A. And the upper boundary of the B may not be so diffuse that a vertical distance of more than 12 inches is required to find the changes in clay contents defined above.

If no A is present, or if there is a lithologic discontinuity between the A and B, no ratio or difference in amount of clay in the A and B can be used. In such cases, a textural B needs only to show nearly continuous clay skins in some pores and on some vertical and horizontal ped surfaces (if the soil has structure).

If the B has developed in sands as a series of lamellae (called fibers in many European countries) only the clay content of the lamellae or fibers is used for comparison.

Textural B horizons should lack the brittle properties of fragipans when moist. Fragipans may show many clay skins and have as much clay increase as some textural B horizons; nevertheless, it is intended to consider horizons with properties of both fragipans and textural B horizons as fragipans.

Bn - Solonetzic B - is a textural B with prismatic or columnar structure, with some part having 15 percent or more saturation with replaceable sodium or with more milliequivalents of replaceable Na plus Mg than Ca plus H.

Bh - Humus B is an illuvial concentration of organic matter without iron but with or without aluminum. It is a pronounced concentration of humus relative to horizons above or below. It does not turn red upon ignition, indicating absence of iron.

Bi - Iron B is an illuvial accumulation of hydrated iron oxides in combination with at least 1 percent humus, with or without hydrated aluminum oxides. The concentration of "free oxides" is measurably greater than that of underlying related horizons and typically decreases with depth within the iron B. If the maximum of free oxides and humus coincides with a maximum of silicate clay that meets the requirements of a textural B, the horizon is to be classified as a textural B. The associated organic matter has a C/N ratio greater than 14, and the clay fraction has a silica sesquioxide ratio measurably, and usually markedly, less than that of the C, and commonly less than 1.0. Parts of a B that meet the requirements above, that turn red upon ignition; and that have value and chroma of 3/2.5 or darker or weaker may be designated as Bhi, humus-iron B.

Bhi - Humus - Iron B is an outstanding illuvial accumulation of humus with hydrated iron oxides with or without aluminum. It must have value and chroma of 3/2.5 or darker or weaker to differentiate it from Bi. It must turn red upon ignition to differentiate it from Bh. It is commonly the uppermost part of a Podzol B, underlying an Ae and overlying a Bi.

Bs (?) - Color B is an horizon in which liberation of sesquioxides without measurable illuviation has developed consistently measurably redder or stronger colors than those of leached and oxidized zones of the C without concentration of silicate clay, sesquioxides, or humus adequate to qualify for a textural B, iron B, humus B, or sesquioxide horizon.

(Most workers outside the Northeast apparently see little value in color B and have found that the definitions of 1957 and the 5th Approximation included Manual C_1 horizons. For that reason the definition is based on a comparison with leached and oxidized zones of C, recognizing that in the absence of C other

comparisons are needed. There was no opportunity to attempt complete definition in the time and with the experience available. Note that the definition of Master B excludes C_1 from this as well as other B horizons. Note also that color B takes precedence over structural B.)

Bf - Structural B is an horizon of altered material below an A having medium or finer prismatic or coarse to fine blocky structure that is
(1) at least moderate in grade and,
(2) unlike structure in A and C or,
(3) at least one grade stronger and one size class larger or smaller if similar in type to that in A or C,

and lacking concentration of silicate clay adequate to qualify as a textural B or color adequate to qualify as a color B. Compound prismatic-blocky structure and prismatic structure with granules are common. There is less than 25 percent unaggregated material. (It will be noted that the lower case "f" is used for a completely different connotation than that involved in Of. This was intentional. It was pointed out during the oral report of the committee to the conference that possibly every combination of master symbols and lower case letters should be considered as a completely independent unit and that lower case letters possibly should not be defined independently for application with the same meaning to more than one master horizon. This question was not discussed fully and is left as an order of business for next year.)

3. S, L, and F horizons

There was considerable difference of opinion about S and F. Few knew enough about L to express an opinion. Several proposed use of Bf or comparable notation for fragipans. At St. Louis, the committee was unable to do more than touch on these problems, and the definitions that follow are those of a tentative draft of this report circulated prior to the conference. (A post conference communication from one committee member pointed out that the symbol S conflicts with the 1956 committee's genetic proposals and that L and F as proposed conflict with designations in forest soils literature and proposed alternatives R, J, and Q respectively. If this were done, D could be substituted for R in the 1957 proposal.)

S Master horizon - A Sesquioxide Horizon is a residual concentration of clay-size minerals consisting of sesquioxides with varying amounts of of silicate clays, usually have 1/1 lattice, mixed with varying amounts of quartz or other minerals highly resistant to weathering or solution. The free sesquioxides exceed 12 percent of the silicate clay which is mainly unoriented. The horizon has diffuse lower boundaries and gradual or diffuse upper boundaries if an Ap is absent, common or frequent pores visible without a hand lens, but is exclusive of any surface mineral horizon of high organic matter content. Clay skins are lacking, or may be present on some horizontal or vertical ped surfaces or fine pores, but not on all or most surfaces. If the silicate clay content exceeds that of the overlying horizons by more than the limits of a textural B, the transition must be very diffuse (greater than 12 inches).

L Master horizon - A Sesquioxide Sheet is a more or less compact platy continuous sheet or layer of concentric concretions, enriched with sesquioxides, hard or soft, with clear or abrupt lower boundaries, and commonly found at the base of slopes, at lithologic discontinuities, or other positions where lateral movement of water could be expected. If soft, sesquioxide sheets harden on wetting and drying, and many have apparently hardened or were formed into a hard state without drying.

F Master horizon - A fragipan is a loamy subsurface horizon, usually underlying a B, very low in organic matter, with high bulk density relative to the solum above, seemingly cemented when dry, having hard or very hard consistence, but, when moist, with moderate or weak brittleness (tendency for a ped to rupture suddenly rather than undergoing slow deformation as increasing pressure is applied). It is usually mottled, slowly or very slowly permeable to water, and has few or many bleached fracture planes forming polygons. Fragipans are most commonly found with abrupt or clear upper horizon boundaries at depths of 15 to 40 inches below the original surface. They vary from a few inches to several feet in thickness and have gradual or diffuse lower boundaries. They are nearly free of roots except for the bleached cracks. Clay skins are scarce to common both in the polygonal cracks and in the interiors of the peds.

4. C, D, and R layers

There was vehement dissatisfaction with the 1957 proposal and equally emphatic expression of satisfaction by those who supported these proposals. It was pointed out that the use of 3 instead of 2 or 4 distinct layers beneath the solum appears illogical. One suggestion involved 2 master symbols, one for similar and the other for dissimilar materials (essentially Manual C and D). The other suggested 2 master symbols, one for consolidated and the other for unconsolidated material with subclasses for similar and dissimilar materials relative to the solum. The latter was supported by the Western Conference, which recommended use of Roman numerals for discontinuities below the solum.

With only one exception, committee members at the National Conference supported the Western proposal, which is presented for trial. (Symbols used for this trial are not pertinent to the trial and are subject to change.)

C Layer - A layer of unconsolidated material, relatively little affected by the influence of organisms. It includes material presumed to be either like or unlike that from which the solum, if present, has developed. Discontinuities within the C layer or between it and a solum above it are to be indicated by the convention adopted for similar discontinuities within the solum. (The committee did not explore fully the question of cementation by soluble material, such as carbonates. As written, a cemented "Cca" would become "Rca". This is contrary to the Western Committee proposal.)

R Layer - Consolidated material, either similar or dissimilar to that from which the parent material of the solum is presumed to have been formed. Discontinuities between the R layer and unconsolidated material above or below are to be indicated by the convention adopted for similar discontinuities within the solum. Layers presumed to have been C but cemented by calcium carbonate are to be designated as Rca.

5. General conventions

(1) Arabic numbers are recommended to be used solely for vertical numbering of subdivisions of horizons at the right of lower case letters if used. This was opposed by some unless the convention proposed for transitional horizons could be changed. (Some preferred Manual convention to 1957 proposals for transitional horizons.)

(2) Roman numerals to be used at the left of master horizon or layer symbols to indicate successive lithologically dissimilar materials. This was not questioned until the meeting of the committee, where it was opposed vigorously as a mandatory convention but was supported as an approved alternative to Manual U. This latter, allowing either Roman numerals or u to be used as approved conventions, is the recommendation for trial. The proposal for C and R above makes use of one or the other mandatory both in and below the solum.

(3) Transitional horizons were thoroughly questioned from two standpoints:

(a) Symbolization. There was dissatisfaction with the 1957 proposal among committee members present. It was pointed out that the combination of 2 master symbols implies equal properties of both. It was suggested for trial that the subordinate master horizon be indicated by lower case letter, as A_3 = Ab or B_1 = Be. This would conflict with Ae as defined for a subclass of A, and probably with others. There was strong feeling for retaining Manual AB and similar combined symbols. There was also strong feeling for A & B instead of A-B. These questions were not resolved by the committee.

(b) Can transitional horizon symbols, as AB, BC, etc. be used when one of the master horizons is absent. A case in point is BC in Manual A-B-D profiles.

Half of the committee would require the presence of both master horizons. An equal number would allow BC as a special case in which the horizon is an "intergrade" from B to a presumed parent material. It was pointed out that one normally draws conclusions about at least the gross character of parent material when he used Manual D. Consequently the use of BC involves no greater assumptions. On this basis, BC is recommended for trial. (It will be noted that BC is appropriate even under the proposal for C in this report).

(4) Convention for Paleosols. Dr. Ruhe has proposed the use of P preceeding the master horizon designation and following the Roman numeral, if used, to indicate Paleosol horizons. Too few had seen Dr. Ruhe's paper in SSSA Proc. 22: p 66. to permit expression of opinion. This is recommended for trial by the new committee.

(5) Use of symbols for degree. Almost everyone has agreed that symbols should not be used to express degree, but half of the committee recommended g and gg to show degree of gleying. This was not discussed at the conference.

6. Lower Case Letter Symbols

The committee proposes to confine lower case symbols to single letters but was not able to study all involved. This should be an order of business for the new committee. Following is a summary of lower case letters and their use under proposals of this report. Various proposals were made both at the conference and by correspondence after the conference for symbols that would replace double lower case letters. These proposals varied greatly among individuals and are not reproduced here.

A. Manual symbols

b - use tentatively for buried soils if preferred
ca - as defined
cn - as defined
cs - as defined
f - drop as defined - see below
g - to cover all degrees of gleying
h - confine to specific definitions of Oh, Ah, Bh, Bhi
ir - drop and substitute "i"
m - drop
p - confine to Ap as defined
r - drop
sa - as defined
t - use exclusively for Bt as defined
u - use at discretion of individual in lieu of Roman numerals
an - mentioned but not listed in Manual. Use as defined

B. New symbols

d - use exclusively for Od as defined
f - use exclusively for Of and Bf as defined
k - frozen soil - replaces Manual f
i - use exclusively for Bi and Bhi as defined
na - use exclusively for Bna as defined
s - use exclusively for Bs as defined

Conference Action

The following are summaries of discussions and actions by the full conference after presentation of the report:

1. The conference agreed that the name "fermentation horizon" for Of is not appropriate because fermentation is anaerobic decomposition. The committee chairman was instructed to substitute another name. (The name "decomposition horizon" has been substituted but the symbol Of has been retained to parallel forest soils F.

2. The committee recommendation that O and its subdivisions be adopted as official conventions was discussed at some length. Dr. Kellogg questioned advisability of making the change now when other revisions may follow and may affect this change. Dr. Smith pointed out that Dr. Muckenhausen and a European group are working on a proposal that has much in common with proposals in this country and observed that if there is any chance of International agreement, we should not prejudice that chance by action now. The conference agreed that O could be substituted for A_{oo} and A_o but Dr. Kellogg requested delay in releasing the decision to permit study of effects of other changes that will be made.

3. The conference voted to place lower case letters and arabic numbers on the same line as the master symbol as recommended by the committee.

4. Disposition of Av as used in the Western States was questioned by Mr. Johnson.

5. The Chairman expressed his opinion that most of the disagreement and shifting opinion within the horizon committee and among members of the conference is a matter of personal prejudice and precedent. He said that in his opinion any one of the various systems proposed would be workable, including the Manual system, the genetic system, or those proposed at various times by the committee. Some detail of definition would be required for all, but in the main, reported problems with all are primarily a matter of the necessity of men making decisions. Consequently, he expressed impatience over the committees' work and questioned the significance of much of their work.

6. As the 1958 proposal requires testing, Dr. Kellogg suggested that the Director of Soil Classification and Correlation and the Principal Soil Correlators test the system within deadlines to be worked out.

7. Dr. Smith expressed concern that the proposed "structural B" would upset the function of "Color B" in the 6th Approximation. Dr. Kellogg instructed Drs. Smith and Cline to resolve these differences before the report is mimeographed. (This has been incorporated in the definitions.)

The conference accepted the committee report and recommendation that the committee be continued.

Post-Conference Notes

After the committee had reported to the conference, Dr. Kellogg suggested that the committee consider the possibility of organizing the system in such a way that alternative degrees of detail of horizon classification could be used. He gave us as an example the textural classes, which can be used in detail or as more inclusive classes, such as coarse, moderately coarse, etc.

This would be entirely possible under the scheme proposed by the 1958 committee, as follows:

1958 Proposal in detail	Selected Groups	Master Horizons
Od	Of & Of	
Of		O
Oh	Oh	
Ap	Ap	
Ah	Ah & Aeh*	A
Aeh		
Ae	Ae	
Bt	Bt & Bn	
Bn		
Bh	Bh	B
Bhi	Bhi & Bi*	
Bi		
Bs	Bs & Bf	
Bf		
S	S	S
L	L	L
F	F	F
C	C	C
R	R	R

*Combinations that may be desirable under column 1.

One could devise a system that would allow use of the detail of column 1, the selected groups of column 2, or the master horizons of column 3, with such subdivision as desired within any one to be shown by arabic numerals.

Correspondence following circulation of this report among committee members not present at St. Louis expressed concern over lack of accomplishment and the shifting sentiments from year to year by committees of different membership. One person suggested a return to the Manual, which was also strongly supported with some modification by committee members at St. Louis. This is reasonably consistent with Dr. Kellogg's post-conference proposal referred to above.

Committee Members:

*M. G. Cline, Chairman
*J. K. Ableiter
M. E. Austin
F. J. Carlisle
*W. G. Harper
Ellis G. Knox
*W. H. Lyford
I. L. Martin
*C. A. Mogen
Harvey Oakes
*G. A. Quakenbush
R. V. Ruhe
*E. H. Templin
E. P. Whiteside

*Attended the committee meeting and participated in preparation of the final draft of the report. Copies of a rough draft of this report were circulated to committee members not at St. Louis and comments and suggestions received have been incorporated in the report or have been summarized in appropriate places prior to mimeographing.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Committee on Use of Published Soil Maps (Including Report on Field Trial of their Use in Farm Planning)

This is the second report of the Committee on Use of Published Soil Maps in farm, ranch and watershed planning. As stated in the 1957 report, the major objectives of the committee are: "(1) we need to decide from time to time on specifications for the soil maps, (2) we need to help SCS people to make the best possible use of the soil survey maps and reports that are to be published, especially of the large-scale mosaic maps that are currently being produced, and (3) procedures are needed for making better use of other published soil maps and reports. Most of these are colored maps of various scales. We have a large number of these published soil maps and many of them are not used as effectively as they could be in farm, ranch and watershed planning."

Mr. Williams, Administrator, SCS, appointed a committee to conduct a work improvement study on the use of published soil maps in planning. Members of this committee are R. D. Hockensmith, F. M. Orsini, Val Silkett, and J. H. Wetzel. Under the leadership of this committee, a study was made during 1957 in four counties where advanced sheets of soil maps on mosaic base were available. These counties were Pasquotank and Watauga Counties, North Carolina; Houston County, Tennessee; and Brazos County, Texas. In each of these counties a team of soil scientists, soil conservationists, and cartographers developed procedures and evaluated the soil maps during conservation planning operations. Each of these teams reported their observations, findings and recommendations to the Washington office committee. Their reports were made available to this committee of the national conference and to the corresponding regional committees.

The following conclusions have been summarized from the reports on these trials:

1. Published soil survey maps can be used in farm planning.

   a. Most farmers and farm-planning technicians would like to have printed soil maps at a scale of 1:7920 (8 inches equal 1 mile). Of the choices offered in these studies, they prefer a scale of 1:15,840 (4 inches equal 1 mile) and can use one of 1:20,000 (3.17 inches equal 1 mile). If a publication scale of 1:20,000 or 1:15,840 is selected for reasons of economy, some of the published maps will need to be enlarged for the convenience of farmers and farm-planning technicians. Enlargements are likely to be needed where (1) farm units are small, (2) cropland is scarce, (3) high-value crops are grown, and (4) a wide range of capability units occurs on one farm.

   b. The soil map needs to be accurate and to contain the soils information that is useful in farm, ranch and watershed planning.

c. To permit effective use of published soil maps, soils need to be correlated so as to permit their placement in capability units and other interpretive groups. A range too wide in slope or other characteristics of a correlated mapping unit greatly reduces the usefulness of a published soil survey for farm planning.

2. There was little or no difference in the time used in planning using published maps as compared with present procedures. Brazos County, Texas, however, reported a 20 percent increase in time because the slope class ranges on the published maps differed from slope class ranges used in developing the work unit technical guide. Some field work was necessary to interpret slope mapping and add needed slope class boundaries.

3. Some photographic detail was lost in preparing the photo mosaic. (Comment: While some photographic detail is lost in the lithographic process, we feel that present results are adequate for all purposes.)

4. Where soil maps were colored by hand to show capability or other groupings, the technicians found some of the published maps difficult to color. (Comment: One of the trial counties was published on glossy paper. This was the first mosaic type map printed and the specifications were changed immediately thereafter to ordinary map stock paper.)

5. The use of a single symbol (one letter or two letters) on the published maps instead of a 3-factor symbol--soil type, slope class, erosion class--causes difficulty in interpretation on some mapping units, especially for capabilit groupings, and takes more time to use in planning work. (Comment: 3-factor symbols are now being specified for sloping eroded soils on most of the soil maps being prepared for publication.)

6. Printing published maps on both sides of the sheet causes problems in using the maps--especially when parts of a farm occur on both sides of the same sheet. (Comment: For economical reasons, SCS will continue to print the maps on both sides of the paper but will provide a sufficient number of copies of each sheet to the work unit to permit ready matching of parts of farms that occur on more than one sheet.)

7. Letters used as spot symbols were difficult to interpret and were confused with alphabetical soil symbols by some users of the maps. (Comment: When letters are used as spot symbols, the present policy is to use lower case, slant type for the spot symbols.)

8. Precinct lines shown on the maps of Brazos County, Texas, were found not to be useful and, in fact, detracted from the use of the maps. (Comment: In most areas boundaries of minor civil divisions are useful. If they are not desired on a published map, a recommendation to omit them should accompany the field map when they are sent for compilation.)

9. The work groups noted that roads are not classified in detail on published maps. (Comment: Present policy is to hold road classification to two

classes--good motor and poor motor. All federal highways carry highway numbers. Further breakdowns by kinds of surface, together with identification of roads (State, county, etc.) would not be economically feasible considering the rapid changes now taking place in the country's road system. All roads show on the mosaic, and while not completely identified, they are available for location purposes.)

10. Published soil surveys, suitable for farm and ranch planning, are suitable for watershed work.

11. The folio of published maps is a big help to the work unit conservationist. He has with him at all times a complete soil survey of the county and doesn't have to worry with copies of the field sheets that have a very limited coverage of the work unit area.

Committees from three regional technical conferences dealt directly with this subject in 1958 and two of them submitted reports to the chairman of the national committee on use of published soil maps for farm, ranch and watershed planning. These reports are summarized as follows:

A. Soil Survey Maps

1. Sheet layout for photo mosaics should be based on land grids where area is sectionized. (This is now being done.)

2. Scale of published maps should be determined and work plans amended, if necessary, as soon as the degree of detail of the survey has been ascertained. Copies of representative field sheets should be furnished to the Cartographic Division if there is any question about whether the information can be shown at a scale of 1:20,000. The committee recommends a publication scale of 1:20,000 wherever the degree of detail permits. Published maps can then be enlarged to 1:7920 if an 8-inch map is desired for farm planning. Consideration should be given to publication at 1:15,840 (4 inches) wherever the published soil maps can be used in farm planning directly, without enlargement.

3. Three-part soil symbols for sloping eroded soils were recommended by one regional committee in 1958 and by me in 1957. Such symbols are now being specified for most published soil maps. In a few areas the State Office of SCS and the cooperating agencies requested simple alphabetical symbols.

4. One regional committee stated that extreme care is needed during correlation to keep to a minimum any combinations of soils that have significant differences in use and treatment, even though the mapping units may be small in total extent.

5. One committee noted the need to eliminate conflicts in symbols which may occur if it is found necessary to make photographic enlargements of published maps. For example, solid line streams in black and soil boundaries in red appear the same when photographed.

6. The quality of field mapping should be carefully checked and brought up to the highest possible standards prior to publication.

7. Consideration should be given to the printing of the soils maps on front and back of sheets in such a manner that farms extending from one sheet to another can be properly matched together. Difficulty has been encountered in farm planning where part of the farm occurs on the front of the sheet and part on the back of the sheet. Cartographic will overcome as much of this as possible.

B. Contents of Reports.

1. Keep census data and historical material to a minimum--census data dates a publication and is normally available in other reports. These are intended as guides and the committee does not believe that all this information should be eliminated. Data pertinent to the agriculture and other data that does not change rapidly should be included.

2. A study be made to determine if tabulated data could be combined in fewer tables. Examples are tables 2 and 6 and capability groupings on page 38 of the Pasquotank County, North Carolina report of 1957.

3. One regional committee recommended publication of supplementary reports. These special reports may contain detailed soil management, fertilizer recommendations, etc., and be prepared by the Experiment Stations or the Extension Service in cooperation with other public or private organizations. This would provide a means of keeping soil management and fertilizer recommendations current and for releasing new information. In discussing this recommendation, the national committee noted that soils handbooks should be prepared by the agencies making a soil survey and should be furnished, usually in draft form, to SCS and to others who help farmers with soils information. It was also mentioned that some states have found it desirable to publish interim reports. The need for interim reports might diminish if soil surveys can be published promptly and soils handbooks can be prepared in early stages of each survey for use by technical people.

4. Capability units should be used for management groupings for major field crops in future soil survey reports and other interpretive groupings that will affect major crops should be made wherever they will be useful. The general over-all capability groupings at the class level may cover all kinds of soil and landscape. It is desirable to develop management groupings for range, woodland and other uses.

Some evaluations were made on published maps not on photo mosaic for use in farm, ranch and watershed planning. This was a follow up of item No. 3 of the committee report of 1957.

Woods and Okfuskee Counties, Oklahoma, were evaluated. The Area Conservationists took the local leadership in these studies. They developed satisfactory

procedures for the use of the two surveys. Noble, Harmon and Cleveland Counties, Oklahoma, are currently being evaluated. Published soil surveys are also being used for farm planning in Washington State. Tennessee and Tama County, Iowa, are using some of the maps with other modifications. There may be other examples that could be cited.

Recommendations

1. The committee recommends that wide participation should be obtained in preparing soil survey legends and interpretive sections of soils handbooks and soil survey reports. Participants should include range specialists, soil conservationists, foresters, engineers, agronomists and others of SCS, the Agricultural Experiment Station, the State Highway Department, Forest Service, and other agencies.

2. The committee recommends that work improvement studies on uses of published soil surveys be continued by SCS. The committee believes that some of the published soil surveys that are inadequate for farm and ranch planning may be highly suitable for watershed planning.

3. The committee recommends that the older published soil surveys be re-evaluated carefully for use in farm, ranch and watershed planning. If the basic soil separations are adequate and the survey lacks some of the slope and erosion phase separations, the committee feels that procedures could be developed to use the survey instead of planning immediate resurvey.

4. It is recommended that the committee should be continued to consider results obtained from further work improvement studies and to explore further methods and procedures for improving the quality and usability of published soil survey maps.

5. The committee recommends that the study and evaluation of new published soil survey reports and maps in farm and ranch planning be continued.

Committee Members:

*Louis E. Derr, Chairman
*J. K. Ableiter
*T. C. Bass
H. H. Bailey
*B. D. Blakely
C. B. Breinig
*Max J. Edwards
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*Val W. Silkett
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M. E. Springer
J. H. Wetzel
*J. H. Winsor
*H. B. Vanderford

*Those who participated in committee meeting at the St. Louis Conference.

Additional participants at the committee meeting were W. H. Allaway, W. H. Bender, R. D. Hockensmith, Richard Rust, H. P. Ulrich and LeMoyne Wilson.

DISCUSSION

A recommendation was added to the report that the suitability for farm, ranch and watershed planning of all new soil maps as they are published should be studied by SCS. It is urged that the opinions of farmers should be obtained in addition to those of technical workers.

The following comments were made:

Some users of advance sheets of printed soil maps in New York and Pennsylvania reported difficulty in reading the direction of drainage. They suggested that arrows to show direction of drainage should be placed on the maps.

We need to assume that people in the work units of SCS will use published soil maps. It will be necessary to correlate soils and plan for publishing maps with such uses in mind. Many people need to take part in correlation so as to put together the soil units that are useful in farm planning. If SCS maps are to be used in farm planning, that understanding should go out before the reports are written.

Correlated soil names and clear-cut soil symbols give the published soil map a big advantage over the field sheets.

When we decide on the scale of publication, we need to weigh extra costs of a 4-inch map against the cost of making enlargements.

This committee should consider the form and arrangement of soil survey reports as well as the uses of soil maps.

Evaluation of published maps and reports from the standpoint of users is important Too many of us write for our own convenience, not for the user. Many small items, such as width of lines and size and weight of symbols, have a big influence on the usability of maps.

In the studies by SCS what good features of soil maps were reported (the studies were directed chiefly to obtain answers to questions about how the maps could be used).

Many supplementary interpretations of soils will be needed in most districts during the next 10 or 20 years.

Twelve sets of mosaic maps have been printed (including the four tested last summer) and advance sheets have been given out to the work units. Five or six more will be printed by midsummer. All of these should be tested in the field.

Many people use published soil survey maps and reports. The University of California had to reprint a state report on the East Side Mesa even though the soils are not suitable for irrigation and no farms are located there.

Wherever a published soil survey can be used for farm planning by SCS, the Area Conservationist can put more effort into progressive surveys and make better use of manpower than if he assigns a soils man to make resurveys of scattered farms.

In Woods County, Oklahoma, 43 mapping units out of 47 on the published soil map can be classified as to capability. Boundaries of those are correctly drawn. Four mapping units need to be checked by the farm-planning conservationist before the soil map is used with the farmer.

A definite program is needed in each state to obtain distribution and use of each new published soil survey report and map.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Committee on Criteria for Soil Series,
Types, and Phases

Reports have been presented to the National Conference by this committee for the past four years. Regional committees on the same topic have also functioned in the four parts of the country. An outline of topics considered and activities planned by the regional committees are given in the 1957 report; the topics proposed for consideration being restated below:

1. Contrasting substrata as criteria for series and phase distinctions.

2. Soil Series as the lowest category.

3. Definition of allowable ranges within series.

During 1957 activities were restricted to the work of regional committees which functioned in three parts of the country. Regional committees were active in the Northeast, Southern, and Western Regions. The North Central Regional Conference gave major attention to the grouping of soil series into higher categories in the Sixth Approximation and as a result some committees, including that on criteria for series, types, and phases were dropped from its 1958 meeting. It did not have a committee at the 1958 conference on criteria for soil series, types and phasas.

A. Topics Considered by the Regional and National Committees in 1957

1. <u>Contrasting substrata and superimposed parent materials as criteria for series or phases.</u>

The place of contrasting substrata as criteria in differentiating taxonomic units and in differentiating map units was the prime reason for establishment of the National Committee some years ago. Discussions have therefore centered about this topic in both national and regional conferences. During the 1958 regional conference this topic was considered by committees in the Northeastern and Southern Regions. It was not considered by the committee of the Western Regional Conference which had expressed its preference in each of the last two previous annual meetings. The Western Conference has taken the position that depth to contrasting substrata should be a basis for phase rather than series distinctions.

The Southern Regional Committee made limited studies of criteria used in differentiating phases and series. Summaries of these limited studies suggest the following:

a. Phase differentiation is often appropriate in soils with superimposed parent materials overlying contrasting substrata or materials recognized as D horizons.

b. Series distinctions are appropriate in soils with B horizons developed in the superimposed material and in buried B. horizons developed in underlying substrata.

Questions were raised about the possibility of establishing hard and fast rules for use of contrasting substrata as phase or series criteria. It was felt that differences in degree of contrast as well as the existence of contrast would have to be considered.

The Northeastern Regional Committee gave nearly its full attention to the question of contrasting substrata. It reached agreement on a proposed policy which was accepted by the conference and which is urged for nationwide application. Statement of the proposed policy reads as follows:

> "Criteria for differentiation of soil series shall be confined to characteristics of the solum or, in the absence of a genetically developed solum, to the characteristics of the upper 36 inches of soil. As a corollary of this principle, properties of neither C nor D would be criteria for differentiation of soil series except in soils without genetically developed sola within the upper 36 inches."

The report of the Northeastern Committee presents arguments as follows in support of the proposed policy:

> "1. The only claim of Soil Science as a science apart from Chemistry, Physics, Geology, and similar disciplines rests in the soil as a genetic entity. Consequently, soil classification as a tool of that science should be based on the characteristics of genetic parts of the soil where such parts exist. If it is not, the classification system will become a hopeless conglomeration of the concepts of other sciences.
>
> "2. Within the framework of our genetic concepts, we are concerned with the geologic materials in and under the solum from three standpoints involving
>
> (a) properties of the solum inherited from parent material that is now a part of the solum
>
> (b) the influence of former parent material that is now a part of the solum on kinds and rates of genetic processes that have formed the solum
>
> (c) the influence of material beneath the solum upon internal environmental conditions that have affected genetic processes within the solum.

"In all three cases, we are concerned not with parent material per se nor with the material beneath the solum, whether C or D, but with the properties of the solum itself. We have observed the properties of the solum. We conclude that certain changes have taken place in the parent material that is now solum by comparing it with a presumed parent material. The C horizon is not parent material yet--it is merely judged to be like the parent material once was. In our classification we should deal with effects we can describe and measure, not with assumed causes or processes, because to do otherwise would bias our application of the classification to development of theories of genesis. Consequently, it should not be enormously important to our classification whether C horizon is present or not. On these bases, the committee considered that neither C nor D is properly a criterion of classification for the science of soils. Both are highly important for application of the classification to studies of soil genesis and to applied objectives but can be applied by means other than incorporation into the classification system. Although we, as soil scientists, are interested in C and D horizons from several standpoints, this does not imply the necessity of their being criteria of classification.

"3. From the standpoint of correlation problems, the committee also rejected C and D as series criteria on three counts:

"a. The significance of properties of the substratum varies with other properties with which they are associated, including properties of the cultural and physical environment. One kind of contrasting substratum may justify differentiation for applied objectives or genetic implications in one environment but not in another. This makes it virtually impossible to lay down consistent ground rules for use of such properties as differentiating criteria. (This is true of many properties of the solum also.) The committee could see no basis other than empirical judgment for deciding what properties and what ranges of properties of the substratum to use as series criteria.

"b. The important boundaries for applied objectives are not the same in all areas, even on the same kinds of genetic profiles. Establishment of soil series on substratum properties would tie all regions to a single set of boundaries whether or not they are the important ones. Adjustment of mapping units to give the important boundaries then would involve complicated problems of undifferentiated units that would include combinations of whole units of classification, combinations of parts (phases) of two units of classification, or where finer distinctions are needed, either substratum phases or still more new series.

"c. The significance of substratum criteria will certainly change with time as knowledge increases and cultural environments change. Series based on contrasting substrata today will not fit requirements of applied objectives 25 years from now. This would mean a continuing process of redefining, discarding, and creating series, which soil science cannot afford if it is to merit respect as a science.

"4. The recommendation would simplify the problem of defining the category of series and would help to keep our thinking straight. By confining series criteria to genetic properties or, in soils without developed solums, to a depth most influenced by the biological factor, a clear-cut division is made between taxonomy and classification for purely applied objectives. Using this distinction, we should ultimately be able to define the category of soil series and its criteria. If we use non-genetic properties, the problem of defining the category is, at best, made much more complicated.

"5. The committee rejected the argument of need to recognize contrasting substrata as series because of significance for applied objectives. The committee emphasizes that single series now range from nearly level to steep slope and from non-stony to very stony. Consequently, a series is not a homogeneous unit for applied objectives.

"6. The committee reviewed the series of the northeast and concluded that most of those we have considered to be based solely on contrasting substrata actually are legitimate series based on properties of the solum alone. In most cases, contrasting substrata at shallow depth either have modified the solum above by control of internal environment or have part of the solum within the contrasting material. Either is a series criterion under the recommendation of this committee. A list of the Northeastern soil series associated with contrasting substrata with an indication of the effect of the committee's recommendation on them is appended to this report."

The committee report included an appendix listing the effects of the proposed policy on 171 soil series which occur in the Northeastern States and which have contrasting substrata. Out of this total, 136 series would stand because of differences in the solum, 25 could be dropped, and 6 series would be redefined if the policy were adopted. The proper disposition of four series was unknown.

The regional committee reports were distributed to members of the national committee within the past few weeks. Two responses have been received and both dissent from the policy proposed in the Northeastern Region. Both responses also suggest alternative bases for use of contrasting substrata.

One suggests that contrasting substrata should be criteria for series differentiation when those strata occur within the normal root zone of crops adapted to the area.

The other suggests the following as an alternative policy:

> "All differentiating characteristics of soils shall be part of the natural soil classification system. Criteria for differentiation of soil series shall be confined to the stable, differentiating, subsurface characteristics of the soil profile. Relatively greater weight shall be given to genetic parts of the soil where such parts exist."

In explanation of this proposal it was pointed out that the proposed policy would restrict all differentiating characteristics within the plow layer, observable at the land surface, or unstable in character to one or more categories below the level of the series.

Comparisons of the probable impact of the use of contrasting substrata as a criteria for distinguishing series or as criteria for distinguishing phases have not been tested as yet except in the Northeastern region. Plans are to test the consequences of the alternative approaches in other regions as well before an attempt is made to hammer out a proposed policy.

2. Soil Series as the Lowest Category.

Proposals for changes in the series and type categories were made in 1954 and 1956. These have been discussed without the reaching of agreement in the committees of the national and regional conferences. The proposal to make the soil series the lowest category in the natural system of classification, originally made in 1956, was reviewed again in 1958 by committees of the Western and Southern Conferences. The proposal is summarized in the National Committee reports for 1956 and 1957.

The Western Committee noted the trend toward monotype series and toward restriction of allowable ranges within series. It is suggested that the more important subdivisions below the level of the series were now being made as phases. The committee therefore saw no good reason for retaining type and phase, one as a category within the system of classification and the other as a subdivision outside the system. The committee concluded that type or phase could be redefined to include both kinds of subdivisions now made below the series level.

The Southern Committee recognized that there were many monotype series but felt that there were also legitimate multitype series. In the latter kind of situation, type differences are usually reflected in profile differences, especially in soils with moderate to strong horizonation. Hence, the Committee favored the retention of soil type as

the lowest category in the classification system, but an apparent minority favor employment of criteria other than texture of the surface soil as differentiating at the type level.

3. Definition of allowable ranges within series.

This topic was explored in some detail by the Northeastern Committee in 1957, as described in earlier reports of the regional and national committees. In 1958, this topic was considered in the Western and Southern Regional Conferences.

The Western Committee agrees in general with proposals of the 1957 Northeastern Committee on ranges in texture, structure, consistence, and the like. The committee hesitates, however, to set exact ranges in texture. It does endorse the proposal that the National Committee prepare general guides, spelling out permissible ranges for properties within series. Furthermore, the committee suggested that the permissible ranges in hue of inherited color in series of Alluvial soils be not less than one-half letter interval.

The Southern Committee attempted to evaluate allowable ranges series in terms of both necessary and sufficient conditions. Necessary refers to the kinds of characteristics appropriate for differentiation at the series level of abstraction. Sufficient refers to the magnitude of the differences in these various properties - how big must differences be to distinguish one series from its sequential associates. The committee concluded that it might be possible to specify both necessary and sufficient differences for restricted groups of soils, though the ranges specified would not hold for series in other groups. Thus, the committee concluded that sliding scales might be required in establishing allowable ranges for series.

4. Kinds of Phases.

The Western Committee continued its consideration of "climatic" and "vegetative" phases which might, for example, have usefulness in determining range sites for series with wide geographic extent. The committee concluded that the cartographic expression of climatic or vegetative phases on field sheets should be limited to climatic zone or vegetative zone boundaries. Further consideration of the question of such phases was proposed without offering firm recommendations.

The Southern Committee considered the relationship between soil types and phases in conjunction with the proposal to make soil series the lowest category of the national system. Phases are

considered to be of two main kinds, namely, those keyed to the three-dimensional nature of soils and those keyed to profile properties. The committee report lists examples of 11 different kinds of phases recognized in the region. These are slope, terrace, erosion, heavy subsoil, thick surface, shallow, very shallow, heavy substratum, silty substratum, overwash, and drained phases. It was noted in the report that all but the first two of these phase distinctions are keyed to profile differences.

B. Additional Topics

Some topics which may deserve consideration by the committee on criteria for soil types and phases have been brought up recently. Two of these topics are listed in this report in order to record them for possible future consideration.

1. Nomenclature for rocky soils.

A question has been raised about the present nomenclature for rocky soils. It has been suggested that there is an inconsistency between the definitions of soil series, types, and phases, on the one hand, and the instructions for naming rocky phases, on the other. According to the instructions and conventions in the Soil Survey Manual, Hagerstown extremely rocky loam is a phase of the soil type. Yet, as much as half of the area of a mapping unit so named might consist of limestone outcrops. According to the conventions on permissible inclusions within any one phase, Hagerstown extremely rocky loam is in fact a complex of Hagerstown loam and Rockland. In practice, the use of terms such as rocky, very rocky, and extremely rocky in the names of mapping units has been tacit recognition of those mapping units as complexes. Formal acceptance and explanation of such usage has been recommended by one member of the committee. Thus, the term "rocky" as part of a mapping unit would indicate that such a unit was a complex even though the name parallels those of soil types in form.

A further suggestion growing out of the correspondence about nomenclature for rocky soils was that of separate nomenclature for mapping units and for taxonomic units be established. A similar proposal has been considered in the past by the National Committee but has never been fully explored. Further investigation of the possibilities of (a) separate nomenclatures or of (b) modification of the nomenclature for taxonomic units before applying it to mapping units (or vice versa) is proposed among future activities of the National and Regional Committees. This exploration of possibilities would be an extension of earlier efforts and would not be restricted to rocky soils.

2. Overburden thickness ranges

In some instances, phases are set apart and in others, series have been distinguished because of recent sediments of some thickness on top of older soils. For the most part, these mantles cover soils of flood plains. Collectively for all soils so affected, the range in thickness of overlying sediments would be wide. Problems in the recognition of such overburdens at the phase or series level occur mainly where mantles range from about 1 to 3 feet in thickness. A question has been raised before the committee on minimum thicknesses of overburden deserving recognition at the phase level and at the series level. Some consideration has been given to this question in the past but further discussion and possible establishment of guides seems desirable.

Committee Members

*R. W. Simonson, Chairman
*M. G. Cline
H. E. Dregne
*W. G. Harper
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*Those who participated in committee meetings at the St. Louis Conference.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Committee on Mapping Eroded Soils

This committee prepared its report by correspondence prior to the meeting of the conference. All members of the committee participated in the recommendations.

The committee were nine for, three opposed to, and one neutral on the recommendations which follow:

The 1957 conference directed this committee to:

1. Make certain additions and changes in the wording of erosion classes.
2. Provide guide lines for converting erosion classes to erosion phases.

The additions and changes in the wording of erosion classes were incorporated in the 1957 conference report. However, these definitions are incorporated in this report so that you may have them for reference. The definitions given should be considered as replacements for the classes of eroded soils given on pages 261 and 267 of the Manual.

Class 1: Soils in this class show little or no evidence of soil loss or truncation. They may have a few rills, soil drift or places with thin A horizons or surface soils. The plow layer of soils with thick A horizons (8 or more inches) is within the A horizon. The plow layer of soils with thin A horizon, thin sola, (less than plow depth), weakly developed horizons, or sola or horizons ranging from thin to thick in relatively short distances, retains approximately the same physical properties and characteristics resulting from the initial stirring and mixing (making due allowance for changes in organic content and bulk density resulting from cultivation). The range of thickness of the soil mass to the first identifiable layer below plow depth remains approximately the same as the original ranges in thickness. On soils with A horizons normally over 12 inches thick more than 75 percent of the A horizon remains.

Class 2: Soils in this erosion class show soil loss or truncation to the extent that ordinary tillage implements reach through the remaining A horizon, or well below the depth of the original plowed layer in soils with thin A horizons, thin sola, weakly developed horizons or soils with sola or horizons ranging from thin to thick in relatively short distances. Generally, the plow layer consists of a mixture of the original A horizon or surface soil (plow layer) and underlying horizons. Soils with this erosion class usually have patches in which the plow layer consists wholly of the original A horizon, or surface soil, and others in which it consists wholly of underlying horizons. Occasional shallow gullies or blowouts may be present. Approximately 25 to 75 percent of the original A horizon or surface soil remain over most of the area. Soils with A horizons 12 inches or more in thickness which have lost more than 25 percent but less than 75 percent of the original A horizon will be included with this class.

Class 3: Soils in this erosion class show soil loss or truncation to the extent that all or practically all of the original plow layer, surface soil, or A horizon has been removed. The plow layer consists essentially of materials from the B or other underlying horizons. Patches in which the plow layer is a mixture of the original A horizon or plow layer and the B horizon or other underlying horizons may be included within mapped areas. Shallow gullies or blowouts are common on some soil types. More than 75 percent of the original plow layer or A horizon, and commonly part or all of the B horizon or underlying horizons have been lost from most of the area.

Class 4: Soils in this erosion class have moderately deep or deep gullies or blowouts occupying 15 to 40 percent of the area delineated. Areas between the gullies or blowouts may have classes 1, 2, or 3 erosion.

This class of erosion will be considered as an erosion phase when the land is reclaimable or where significant for forestry. It may be a Miscellaneous Land type when not reclaimable or lacks significance for forestry or other use.

Class 5: Gullied lands, or Blown-out lands have more than 40 percent of the area delineated occupied by moderately deep or deep gullies or blowouts. Land having these conditions is not to be considered as an erosion phase but should be classified as a Miscellaneous Land type and handled as outlined on pages 307 and 308 of the Soil Survey Manual.

Class 6: Slips and landslides represent mass movement of soil or other unconsolidated materials down slopes in recent times, together with the scarred surface resulting from such movement. These mass movements may be complete and rapid removal of large masses of soil material to lower levels or they may represent a slow downward slipping of a mass of soil, or of several subsidiary masses, usually with some degree of backward rotation on a more or less horizontal axis parallel to the slope. Materials of the lower solum or substrata are exposed as scars where the soil mass broke away from its original position. (Not all Class 6 erosion is accelerated - some may be geologic.) The rapid movement type results in a large denuded area on the hillside and an irregularly shaped mass of talus at the footslopes. The slow movement type commonly has an uneven concave-convex, or sigmoid cross section with wide cracks.

Water and wind erosion may be active in areas affected by slips and landslides.

The definition as given covers all size and kind of slips and landslides. It is suggested that this class of erosion be used for slips and landslides on land areas that can still be utilized for crops, pasture or woodland. Small slips or landslides of one acre or less should be shown by symbol, and large slips or landslides which have little or no value for crops, pasture or woodland should be shown as a miscellaneous land type and handled as outlined on pages 307 and 308 of the Soil Survey Manual.

Class 7: Undifferentiated Erosion. This class of erosion is to be used on soils where there is evidence that erosion or truncation has occurred but where it is impractical or impossible to determine the extent of soil loss - either because of the intermixing of recognizable classes of erosion or because of a lack of criteria or reference points for recognizing soil erosion.

GUIDE FOR CONVERTING EROSION CLASSES TO ERODED PHASES

Your committee has considered and discussed guide lines for converting Erosion Classes into Erosion Phases.

Your committee recognized that within a given soil type the same quantity (class) of erosion will not have the same effect or equal significance in the behavior (use, responses or requirements) of the soil when consideration is given to such factors as runoff, moisture relationship, infiltration, erosion rate, tillage or seedbed preparation, fertilizer needs, crop yields, and crop adaptions.

Your committee recognizes that interpretations of the significance of observable facts can and do change with time, circumstances, locations and people.

Your committee concluded that it was desirable to record basic facts rather than interpretations of basic facts on our Soil Survey Maps.

Therefore, the committee favors recording erosion classes on the map calling them phases. As a guide for designating erosion phases it (the committee) makes the recommendations given below.

Recommendations:

1. The Phases of Eroded Soil should parallel the classes of Eroded Soil for classes 1, 2, and 3 except where two classes of erosion approach a common boundary. Under such conditions the two classes could be combined into one phase, using for the phase designation that erosion class which appeared to be dominant.

2. The Erosion Class 1 would be designated as the Uneroded and/or Slightly Eroded phase, whichever was the most descriptive of existing conditions.

3. Class 2 erosion would be designated as the Moderately Eroded Phase.

4. Class 3 erosion would be designated as the Severely Eroded Phase.

5. Class 4 erosion will be designated as an erosion phase where the land is reclaimable or where significant for forestry. The erosion phase should carry one of the following names:

    a. Very Severely Eroded Phase. This name would be used where gullies or blowouts affect less than 25 percent, but more than 15 percent of the area.

    b. Gullied Phase or Blownout Phase would be used where more than 25 percent but less than 40 percent of the area is affected by gullies or blowouts.

6. Class 4 erosion will be designated as a Miscellaneous Land Type where the land is not reclaimable and not significant for forestry.

7. Class 5 erosion will not be considered as an erosion phase but will be a Miscellaneous Land Type.

8. Class 6 erosion will be designated as slips and landslide phase except where the land has little or no value for crops, pasture, or woodland, where it should be considered as a Miscellaneous Land Type.

9. Class 7 erosion should not be converted to a phase but should be listed as Undifferentiated Erosion.

Committee Members:

A. H. Paschall	W. H. Lyford	E. A. Naphan
Henry R. Adams	I. L. Martin	G. A. Quakenbush
W. D. Boyken	P. H. Montgomery	A. S. Robertson
A. J. Cline	L. E. Mitchell	H. L. Wascher
F. G. Loughry		

DISCUSSION

In presenting this report to the conference, the Chairman of the Committee pointed out that the definition of Class 4 erosion used the phrase "where significant in reforestation". Committee members had suggested that "significant for forestry" represented a broader term and one better suited to the situation. The conference agreed and the words "for forestry" have been inserted into the definitions.

Class 7 - Undifferentiated Erosion, caused some floor discussion, particularly where to use the class. It could be used on good soil, on poor soil and on soils where erosion classification was considered to be of no useful purpose. The class could represent a mixture of the various classes, too intimately mixed to separate or it might represent a situation where it was not possible to determine the classes due to a lack of reference points.

Floor discussion on the recommended guide for converting erosion classes to phases challenged the idea that phases of erosion should parallel classes of erosion.

It was emphatically argued that erosion and different intensities of erosion affect different soils, and different soil functions to varying degrees. However, the consensus of the conference opinions was that eroded phases should indicate differences in degrees of effect. Therefore, the committee recommendations were rejected.

Members of the committee present at the conference then met and prepared and presented at a later meeting substitute guides. These were accepted by the conference. These substitute guides have been reviewed by the Director of Soil Classification and Correlation. These substitute guides are as follows:

Certain guide lines are proposed in this committee report for naming eroded phases, mapped according to classes of eroded soils as outlined in the preceding section of the report. The proposed phase concepts are related to the behavior of eroded soils. In other words, phases are designed to record the changed nature of the soils due to erosion when such changes have impact on one or more of use, management, and treatment requirements. It should be noted that phase designations are not proposed for specific classes of eroded soils.

The definitions of uneroded, slightly eroded, moderately eroded, and severely eroded phases outlined below are consistent with the concepts of those phases in the Soil Survey Manual (p. 295) except that effects of water and wind erosion are not differentiated. The proposed very severely eroded phase is in addition to those given in the Soil Survey Manual. This latter phase is intended to cover soil which has undergone marked erosion without destruction of the profile and which is reclaimable.

Proposed phases of eroded soils are:

a. Uneroded or slightly eroded phase. Used where the profile lacks evidence of truncation or the truncation has been so small that significant change in behavior of the soil is not apparent. Use, management, and treatment are essentially the same whether the soil is considered to be uneroded or slightly eroded. Runoff rates; infiltration; erosion rate; adapted species of crops, grasses and trees; tillage requirements; fertilizer needs; and the like are essentially the same for the uneroded and slightly eroded conditions. This phase may be called an uneroded phase, a slightly eroded phase, or it may be named without an erosion term.

b. Moderately eroded phase. Used where the profile has been truncated enough to change the behavior of the soil appreciably. This phase requires different management, treatment, or both from the uneroded or slightly eroded phase, although use for crops, pasture, or forest may remain unchanged. As compared to the uneroded or slightly eroded soil, this requires additional effort and expense for the control of runoff, for the improvement of tilth, for the control of erosion, for the improvement of infiltration rates, and the like. The name of the phase may omit the word "moderately" unless needed to differentiate between this phase and other eroded phases.

c. Severely eroded phase. Used where the profile has been truncated enough to change the behavior of the soil markedly. This phase requires major treatment or a change in use. Examples of major

treatments are heavy fertilization (as compared to uneroded soils), terracing, marked reduction in the intensity of cropping, and the filling of gullies. Commonly, some combination of these kinds of treatment is required. Examples of changes in use are a shift from crops to pasture or a shift from crops or pasture to forest.

d. Very severely eroded phase. Used where gullies (or blowouts) are common and the profile has been greatly truncated but is still readily identifiable over much of the area of the phase. Because the behavior of the soil has been drastically changed from the uneroded condition, extensive reclamation is required. This phase may be named as a gullied phase or as a blowout phase where such terms are more accurately descriptive.

Miscellaneous land types should be recognized for areas in which the soil profile has largely been destroyed by erosion. If the major part of a mapping unit lacks identifiable soil profiles, it should be called a miscellaneous land type rather than a phase of some soil type. An example of such a land type is "gullied land", defined in the Soil Survey Manual (p. 295). Reclamation of miscellaneous land types for use in crop production is not feasible, but some areas may have usefulness for forestry, range, or wildlife.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of Committee on Soil Structure Grades

The committee was established about 2 years ago and prepared its first report after meeting at the 1957 conference. Certain recommendations were then made with regard to concepts and recording of grades of soil structure.

A. Action on Report of 1957 Committee

The recommendations made by the committee in 1957 were as follows:

1. Soil structure grades should continue to express degree of aggregation as outlined in the Manual; that is, organization of the aggregates should be described separately.

2. Moisture content of the time soils are examined should be recorded along with structural features.

3. Reference standard locations should be established as an aid to standardization of structural grades.

4. A committee should be established to develop standards for describing the organization of natural peds. A specific charge would be to evolve field criteria for describing thickness, continuity, and position of colloidal coatings occurring on ped faces and within pores and channels. Field criteria should be established for differentiation between oriented versus unoriented and organic versus inorganic colloids.

The recommendations offered by the National Committee were considered in the work-planning conferences in the North Central and Western Regions. Committees on grades of soil structure were not established in the other regions.

B. North Central Regional Conference

The committee of the North Central conference was in general agreement with the recommendations contained in the 1957 report of the National Committee, but felt that more precise definitions of grades would lead to more consistent and objective evaluation. Soil structure grades, according to instructions on page 229 of the Soil Survey Manual, should be evaluated on the basis of proportion of material aggregated, distinctness of aggregates, and durability (mechanical strength) of individual aggregates. The committee concluded that further efforts should be made either to substitute classes of each of the above three qualities for grades of

structure or to define the several grades of structure more precisely in terms of the three qualities listed above. The first and last of the three criteria for evaluating structure can be estimated or measured rather easily, whereas distinctness of aggregates is more difficult to evaluate. Discussions of the committee touched on types of structure, on describing structure in organic soils and on several related topics. The North Central committee summarized its discussions with the following proposal:

> "It was the general consensus of the committee that although the Manual provides standards and conventions for describing soil structure that have helped greatly to standardize our descriptions of soil structure, these standards seem to be inadequate in some respects, and further study of them seems desirable. The committee recommends that the present committee on grades of soil structure be terminated and that a committee of broader scope be established to consider possible improvement in our present standards for describing soil structure."

C. Western Regional Conference

The committee of the Western conference agreed generally with observations and recommendations of the 1957 work-planning committee. It suggested, however, that present definition of grades in the Soil Survey Manual be revised to omit the word "durable". Committee members believed that the use of the word "durable" in definitions of the moderate and strong grades had encouraged use of consistence as one criterion for evaluating grades. In order to avoid this difficulty, the committee revised definitions of the two grades as follows:

> " Moderate - That grade of structure characterized by well formed peds that are moderately evident but not distinct in undisturbed soil. Soil material of this grade, when disturbed, breaks down into a mixture of many distinct entire peds, some broken peds, and little unaggregated material. Examples, etc...
>
> "Strong - That grade of structure characterized by well formed distinct peds that are quite evident in undisplaced soil, that adhere weakly to one another, and that withstand displacement and become separated when the soil is disturbed. When removed from the profile, soil material of this grade of structure consists very largely of entire peds and includes a few broken peds and little or no unaggregated material. If necessary, etc..."

The Western Conference did not accept the recommendations of its committee. It asked that further work be done to provide alternative proposals for defining grades of soil structure.

D. Present Status and Recommendations

The responses from the two regional committees indicate the need for further work on characterization of soil structure. Letters from members of the National Committee also indicate such need. Furthermore, there continue to be reports of differences in characterization of structure of horizons by individuals who examined the soil at the same time. Consequently, it is recommended that the Committee on Soil Structure Grades be replaced by one dealing with soil structure generally. Such a committee could appropriately look into definitions of grades of structure as well as the organization of substances within peds and the need for any changes in types and classes of structure in the system now being used.

Committee Members:

Roy W. Simonson, Chairman
F. J. Carlisle
W. C. Bourne
R. R. Covell
Joel Giddens
G. B. Lee
B. L. Matzek
C. A. Mogen
H. Howe Morse
J. E. McClelland
A. E. Shearin
Guy D. Smith
J. H. Winsor

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Committee on Small-Scale Maps

I. Background:

A. The 1956 report of this Committee sets forth eight characteristics that State land resource maps should have. (These characteristics are equally applicable to generalized State soil maps.) The eight are:

1. Resource area boundaries should be sufficiently accurate that the delineations for individual counties can be used for general agricultural planning at the county level. This means that State maps are, in effect, an assemblage of general county maps.

2. The map units should be organized into not more than about 10 groups designed to have maximum agricultural significance to planning at the State level. This grouping should not exclude other possible interpretative groupings.

3. Soil boundaries are to join across State lines.

4. Map units should be phases or associations of phases of great soil groups or of taxonomic units of Category V of the Fourth or Fifth Approximation of the new soil classification system. (This was modified in 1958, see par. III H.)

5. There should be two legends or a combination legend designed (a) to define the map units pedologically in terms of proportions and distribution pattern of the component phases of taxonomic units, and (b) to define the map units in practical descriptive terms for those dealing with objectives involving soil use and management.

6. The compilation scale should be 1:500,000.

7. The publication scale should be 1:1,000,000.

8. The minimum size of areas on the 1:1,000,000 scale map should be at least one-fourth inch across for generally circular areas, and at least one-eighth inch across for long, narrow areas.

B. In the 1956 report it was also suggested that the Arkansas, Red and White rivers watershed soil map (1951) be considered a general model for publication scale (1:1,000,000), cartographic and categorical levels of generalization, and concept of mapping units, and that available soil and problem area maps be exploited fully in making new maps.

C. In 1957, this Committee did not meet; but, on the basis of correspondence, it was concluded that a majority of the Committee still favored the kind of map proposed the preceding year. Two legend arrangements, one tabular and the other non-tabular were submitted to the Committee members for consideration. An overwhelming majority favored the non-tabular legend arrangement.

D. One of the difficulties in making others understand the 1956 recommendations was the lack of any State map prepared according to specifications set forth that year. To overcome this shortcoming, the new (January 1, 1957) Land Resource Area Map of North Dakota was selected for development into a model. This work was done by Dr. John F. Douglass, with some help from other soil scientists; the SCS Cartographic Division did the redrafting and printing. Two versions, termed Experimental Sheet No. 1 and No. 2, respectively, were prepared plus an alternate legend for Experimental Sheet No. 1.

II. Objectives this year (1958): To consider:

A. The Experimental Map Sheets of North Dakota.

B. Names of generalized maps.

C. Use of series names on State maps.

D. Attainment of uniformity.

E. Criteria for organizing legends.

F. Standardization of generalized county soil maps for inclusion in soil survey reports.

III. Discussion and Recommendations:

A. North Dakota Map Sheets:

1. Experimental sheets 1 and 2 were adapted from the 1:1,000,000 January 1, 1957 Land Resource Area Map of North Dakota. The original black and white North Dakota map includes a separate legend in two parts. Part 1 groups the 196 map areas by physiographic regions, and describes each map area by dominant soil series, topography, and other characteristics.

Part II lists the 98 soil series in alphabetical order, and describes for each in tabular form the great soil group, texture of surface, texture and kind of substratum, and sub-surface drainage.

2. Over-all results of this map revision, as presented by experimental sheets 1 and 2, has been to produce a simpler map. This has been achieved mainly through legend organization and not through the elimination of cartographic detail. These experimental sheets illustrate map models based, with slight modifications, on the guidelines established by the National Committee on Small-Scale Maps in 1956 and 1957.

3. <u>Map</u>

   a. 1:1,000,000 scale

   b. The map is detailed enough so that delineations within individual counties may be used for very general agricultural planning at the county level, and in comparing one county with adjacent counties.

   c. Orientation is given by latitude and longitude, county boundaries, rivers, towns, highways, and graphic map scale. Note that only principal towns and major highways are shown.

   d. Minimum size of area is at least one-fourth inch across for generally circular areas, and at least one-eighth inch across for long narrow areas.

   e. Map units are associations of soil series.

4. <u>Legend</u>

   a. Soil associations similar in soil characteristics and in their relation to agriculture are grouped together even though they may be geographically separated.

   b. Brief descriptions, including both pedological and descriptive terminology, are in terms of soil characteristics with one exception (the heading, "Soils of Stream Valleys", on Map Sheet No. 1).

   c. Map units are organized so that the information may be used at more than one level of generalization. Color greatly enhances the ease of map use but is not absolutely necessary.

(1) Eight top-level groups (shown by colors) are designed to have maximum significance at the State level.

(2) Eighteen intermediate groups are defined in descriptive terms (and shown by color-pattern combinations on sheet No. 2 only).

(3) Sixty-nine map units are associations (identified by numerals) of soil series. It is assumed these units would be further described in an accompanying table or text or some combination of these two.

d. The legend is printed on the face of the map in numerical and alphabetical order with the major groups arranged generally in descending order of agricultural importance.

B. Correspondence was received from nearly all those Committee members not present at this Conference and their comments along with reports from the Northeast and Southeast regional committees were considered at the meeting of this Committee at St. Louis.

C. In the course of evaluating the North Dakota experimental map sheets, the question of whether physiography should be emphasized was raised. Note that on the North Dakota map sheets, physiographic regions are not shown. Discussion revealed that the tradition of showing physiographic regions or organizing the map units by such regions is firmly entrenched. The observation was made that maps showing the distribution of soil associations will in many States, perhaps in most States, have boundaries that are coincident with physiographic boundaries. It was also pointed out that if physiographic regions need to be shown, they can be shown by some device, such as a small inset map, that will not interfere with the grouping of map units on the basis of soil characteristics. While the question was not explicitly answered by the Committee, the consensus of the majority appeared to be that the map units should be organized on the basis of soil characteristics and not on the basis of physiography, although to indicate in the legend the physiographic regions in which map units occur would not be objectionable.

D. A suggestion was made that some formula should be devised so that scales larger than 1:1,000,000 would be recommended for the small States, such as New Jersey and Delaware, and scales smaller than 1:1,000,000 be recommended for the larger States such as Texas and California. No action was taken on this proposal.

E. In regard to the North Dakota experimental map sheets, all but two Committee members indicated, at least by inference, that they were satisfactory as examples of kinds of maps the Committee wishes to recommend. As regards preferences, opinion was divided, but a small majority favored No. 1.

1. RECOMMENDATION: That Experimental Sheet No. 1 be adopted as the preferred model of the kind of map that should be prepared as new State maps are produced.

2. RECOMMENDATION: That if such maps are not to be reproduced in color that appropriate black and white "zip-a-tone" patterns be substituted for the colors.

F. As regards preferences of the two legends prepared for Experimental Sheet No. 1, the Committee again was divided, but the majority preferred the legend on the map sheet instead of the alternate one. These two legends are alike except for the arrangement of the explanations of the top level groups. The legend on the map sheet has non-technical terminology in large print; the alternate legend has the technical terminology in large print. Both sets of explanations contain the same information.

1. RECOMMENDATION: That the legend on Experimental Sheet No. 1 be adopted as the preferred model.

G. Name of map: A great variety of names have been applied to maps that that are essentially generalized soil maps. Several good reasons were given for including the term "soil" in the name. Among these are: The term can be understood by everyone and needs no further explanation; the term "soil" distinguishes the map from geologic, topographic, and other kinds of maps; and the term avoids incorrect cataloging in libraries.

1. RECOMMENDATION: That the name "SOIL MAP (GENERALIZED) for (indicate State)" be used for those maps that are not "land resource maps".

a. It was anticipated that a State would have either a generalized soil map or a land resource map, not both. A land resource map, as defined in Administrator's Memorandum SCS-127, June 4, 1957, is "a soil association map having areas subdivided where necessary to show differences in climate, water resources, land use, or type of farming <u>where these items are important to soil and water conservation and where the areas can be defined and identified by boundaries on the map</u>."

b. In view of the restrictions set forth in this definition, an opinion was offered that perhaps many States will have a generalized soil map, and only a few will have a land resource map. A good generalized soil map, organized as recommended by this Committee, in most States will serve the very objective intended for land resource maps. Attainment of this objective can be greatly enhanced in many States by using phase separations, where mappable, to accommodate soil differences highly significant to agriculture that exist within soil association areas.

H. Series Names: The Committee appreciates the desirability of using names in taxonomic categories above the level of soil series on generalized maps of States. At the same time it recognizes that names of soil series have become well known in many States while the names of soil families have not yet become established and the names of great soil groups soon will be superseded.

1. RECOMMENDATION: That series names, where reasonably well known, be used as names for map units, which generally will be associations of series. (Some map units, however, might be associations of phases of series.) The series names listed should be restricted to the dominant ones in each association.

   a. Where series names are not well known, map units should be defined as families or associations of families as appropriate. Where this is not feasible, map units should be defined as phases or associations of phases of great soil groups or their approximate equivalents in the Sixth Approximation.

I. Attaining Uniform Level of Generalization: It was noted that considerable uniformity in level of generalization has already been attained among many States.

1. RECOMMENDATION: That uniformity be evaluated and improved by:

   a. Reference to accepted examples, such as the North Dakota Experimental Sheet No. 1 and the Arkansas, Red and White rivers watershed map (1951).

   b. Joining map unit boundaries at State lines.

   c. Comparing the manuscript map of a given State with maps of other States, especially adjoining States.

   d. Review by soil correlators.

J. Soil Correlation: It was recognized that soil names on generalized maps should be in line with standard nomenclature.

1. RECOMMENDATION: That soil correlators review and approve, through the regular correlation process, the nomenclature on generalized soil maps--the same as with other soil maps.

K. Criteria for Organizing Legends: How to organize the legends is perhaps the most difficult single problem facing authors of generalized maps. While the Committee did not have time to consider this problem thoroughly, it did recognize the need for criteria to use in organizing legends, and it did come up with some.

1. RECOMMENDATION: That following criteria be used for organizing the legends on State maps:

   a. That the grouping of map units be based on soil characteristics, including slope.

   b. That the number of top-level groups shall not be more than about 10.

   c. That intermediate groups--between the top-level groups and the individual map units--generally are desirable.

   d. That the groups, especially the top-level groups, shall be designed so as to have maximum significance to agricultural planning at the State level.

L. Generalized County Soil Maps for Soil Survey Reports: An opinion was expressed that with the new report format and the large scale of the detailed map along with the necessary separation of this map into many sheets, there is a more important function to be served by the generalized soil map than heretofore. The gap between the generalized maps now going into some reports, perhaps most of them, and the detailed maps, is too great; and, as a result, the utility of our surveys is considerably less than we could make it. Many people find generalized soil maps useful, not only for general information, but also useful in understanding better the detailed map.

   1. RECOMMENDATION: That these maps be partly standardized. For example, scales of such maps perhaps could be limited to 2 or 3, and some guidelines for organization of the legends might be developed. No recommendations of specific standards, however, are made at this time.

M. RECOMMENDATION: That this Committee on Small-Scale Maps be continued, primarily to consider generalized county soil maps for inclusion in soil survey reports, but also to deal with new questions that may arise concerning generalized maps of States.

Committee:

*A. C. Orvedal, Chairman	*D. R. Gardner	*W. S. Ligon
O. W. Bidwell	H. E. Grogger	*W. H. Lyford
C. B. Breinig	*W. G. Harper	Ray L. Marshall
R. R. Covell	C. W. Koechley	*C. A. Mogen
R. E. Devereux	R. G. Leighty	*G. A. Quakenbush
J. F. Douglass		

*Those who participated in committee meetings at the St. Louis Conference.

Participants at St. Louis not members of the Committee were: R. W. Simonson, A. A. Klingebiel, R. W. Chapin, R. Ulrich, F. M. Orsini, J. E. Dawson, A. Leahey, V. W. Silkett, Dr. Charles E. Kellogg.

SUMMARY OF CONFERENCE DISCUSSION OF REPORT

Dr. Kellogg expressed considerable satisfaction with Experimental Map Sheet No. 1. He observed that this map is much better in color than in black and white and explained that the Soil Survey had a long-standing policy of refraining from publishing State maps. Since their use is primarily within States, it seems that State experiment stations should publish such maps. If the SCS were to publish just one State map, such action would likely spark a demand for publication of maps of many other States. To meet this demand would take away money now going into publication of detailed surveys. To publish 500 copies of a map like the North Dakota Experimental Sheet No. 1 would cost about $800; to publish 1,000 copies would cost nearly $900. If reasons exist, however, for changing this policy, it was explained that they would be carefully considered.

Dr. Cline, in response to a question, answered that more than 12,000 copies of Soil Association Map of New York State had been distributed.

Mr. Derr reported that the legend on Experimental Sheet No. 1 and the alternate legend had been circulated among professional workers in other government agencies, including the FHA, FCIC, and ACP offices in Oklahoma. All preferred the legend on Experimental Sheet No. 1--the legend with the non-technical headings.

Dr. Cline said that a need exists for a policy on nomenclature for generalized soil maps.

Mr. Chapin stated that guidance was needed for the preparation of generalized soil maps of counties.

Dr. Gordon Steele reported that generalized maps of two counties in New York, rather recently received by his office, were too large for one folio page. To accommodate such maps increases the cost of publication.

Dr. Cline suggested that a generalized county map at one-half of the scale of the old 1-inch-to-the-mile maps would be desirable.

Dr. Kellogg mentioned in regard to county maps the matter of level of generalization among counties. He called attention to the fact that some counties such as those in eastern Pennsylvania, have highly contrasting soils; whereas other counties, such as those in northern Iowa, do not. If the same level of generalization were to be attempted, counties with highly contrasting soils might have too many boundaries on the generalized maps; and those without highly contrasting soils would have too few. He therefore concluded that to have a nationwide uniformity in level of generalization for county maps for soil survey reports would be unwise.

CONFERENCE ACTION: The Conference accepted the Committee report.

MAP ENCLOSURE: An uncolored copy of North Dakota Experimental Sheet No. 1, the approved model, is enclosed. The name has been changed from "LAND RESOURCE AREA MAP OF NORTH DAKOTA" to "SOIL MAP (GENERALIZED) OF NORTH DAKOTA" so as to bring the name into line with the Committee's recommendations. This map, unfortunately, was too large for the SCS press and therefore it had to be printed as two sheets. In order to view and study this map properly, it is suggested that the two sheets be fastened together and that the map be colored according to the following scheme:*

Map Units	Colors (light tones of)
1 - 27	Green
28 - 43	Yellow
44	Purple
45 - 46	Blue
47 - 53	Gray
54 - 59	Brown
61 - 69	Red
60	Orange

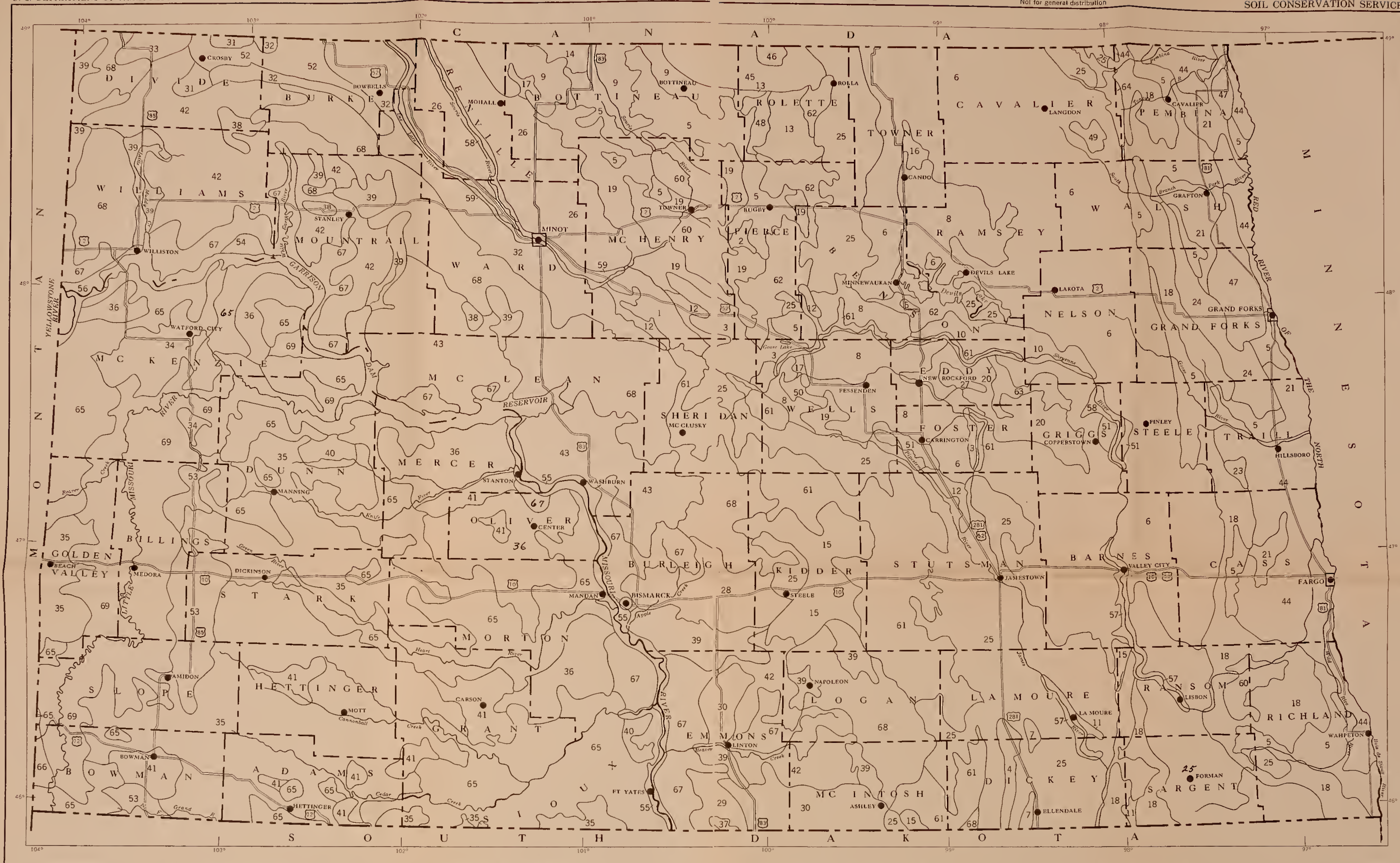
*Place parentheses around the word "GENERALIZED" in the title on the map.

U. S. DEPARTMENT OF AGRICULTURE

SOIL MAP - GENERALIZED - OF NORTH DAKOTA

Experimental Sheet No. 1
Not for general distribution

SOIL CONSERVATION SERVICE



JANUARY 1958

Assistance from the North Dakota Agricultural Experiment Station in preparing this experimental sheet is gratefully acknowledged.

BLACK SOILS IN SUBHUMID REGIONS

Nearly Level to Rolling Soils with Thick Black Surface Layer (Chernozem and Lime Solonchak) and Associated Wet Soils (Humic Gley and Planosol)

Well - and Moderately Well-drained Loams and Clay Loams

1. Barnes, Cresbard
2. Barnes, Dickey
3. Barnes, Hamerly
4. Edgeley, Cresbard
5. Gardena, Glyndon
6. Hamerly, Aastad
7. Medberry, Dickey
8. Ops, Kief
9. Sherwood, Westhope

Well - and Moderately Well-drained Loams and Sandy Loams with Sandy Substrata

10. Bantry, Brantford
11. Dickey, Bantry
12. Dickey, Lovell
13. Dickey, Fordville, Lovell
14. Dickey, Towner, Lovell
15. Fordville, Lovell
16. Gardena, Brantford
17. Lovell, Gardena
18. Lovell, Ulen
19. Maddock, Lovell
20. Wells, Lovell

Moderately Well - and Imperfectly Drained Loams and Clay Loams

21. Bearden, Glyndon
23. Overly, Gardena
24. Selz, Rushford

Well - and Very Poorly Drained Loams and Clay Loams

25. Barnes, Aastad, Parnell
26. Renville, Hamlet, Tetonka

Poorly Drained Sandy Loams

DARK BROWN SOILS IN SEMIARID REGION

Nearly Level to Rolling Soils with Thick Dark Brown Surface Layer (Chestnut) also Associated Soils with Surface Layer less than 4 Inches Thick (deep Regosol and shallow Lithosol) and Wet Soils (Humic Gley)

Well Drained Loams and Sandy Loams

28. Williams, Agar, Lihen

Well - and Moderately Well-drained Loams and Clay Loams

29. Agar, Raber
30. Agar, Williams
31. Des Lacs, Roseglen
32. Kenaston
33. Kenaston, Wildrose
34. Morton, Arnegard
35. Morton, Regent
36. Morton, Williams
37. Raber, Pierre
38. Roseglen, Makoti

Well - and Excessively Drained Loams and Sandy Loams with Sandy Substrata

39. Oahe, Twin Lakes
40. Vebar, Flasher
41. Vebar, Lihen

Well - and Very Poorly Drained Loams and Clay Loams

42. Williams, Parnell
43. Williams, Parnell, Roseglen

VERY PLASTIC AND VERY STICKY CLAY SOILS

Level Soils with Black Surface Layer more than 12 Inches Thick, Cracks Deeply and Becomes Extremely Hard on Drying (Grumusol)

Poorly Drained Clay

44. Fargo, Hegne

FIRM CLAY LOAM AND CLAY SOILS

Mostly Forested Undulating to Rolling Soils Well - and Moderately Well-drained (Gray Wooded and Chernozem)

Clay Loam and Clay

45. Bottineau, Rolette

Clay

46. Rolla, Rolette

SALINE AND ALKALI SOILS

Also Associated Nonsaline and Nonalkali Soils

Saline Soils (Solonchak)

47. Bearden (saline phase)

Alkali Soils with Claypan Subsoil (Solonetz)

48. Aberdeen, Cavour
49. Cavour, Barnes
50. Larson, Gardena
51. Larson, Ops
52. Niobe, Noonan
53. Rhoades, Moline

SOILS OF STREAM VALLEYS

On Bottomlands, (Alluvial) Terraces, and Soils on Adjacent Steep Slopes

Nearly Level Soils Subject to Intermittent Flooding Well - and Moderately Well-drained with Variable Texture

54. Farland, Lihen
55. Havre, Banks
56. Havre, Lohmiller

Nearly Level to Steep Loams and Clay Loams with Variable Drainage

57. Buse, Kensington, Lamoure
58. Buse, La Delle
59. Zahl, Driscoll, Farland

SOILS ON SAND HILLS

Low Hills Intermingled with Nearly Level Land

Loose Sands, Excessively Drained (Regosol)

60. Denbigh, Bantry, Gannett

SOILS ON STEEP SLOPES

Excessively Drained Loams and Sandy Loams with Surface Layer less than 4 Inches Thick (deep Regosol and shallow Lithosol) and Associated Soils with Thick Surface Layer (Chernozem and Chestnut)

Hilly and Steep

61. Buse, Barnes
62. Buse, Dickey, Barnes
63. Dickey, Buse
64. Edgeley Soil Material, Buse
65. Flasher, Bainville
66. Lismas, Gilt Edge
67. Zahl, Bainville
68. Zahl, Williams

Rough Broken Land

69. Bainville, Flasher, Badlands

10 0 10 20 30 40 Miles

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Committee on Relationship of Low Family Groupings to Capability Units

Last year the Southern Regional Committee suggested a possible way of using selected low families for spot-checking capability tables from place to place. The 1957 National Committee accepted this suggestion and the following procedure was adopted by the conference:

1. The correlation staff in each region will select three widely different phases of each of three low families and obtain current capability classifications of them from the State soil scientists of the States in which any of the component series occur. Low families selected should:

   (a) Contain a relatively large number of series.

   (b) Have fairly wide geographic distribution.

   (c) Be ones that are apparently firm in composition.

2. The results will be summarized and turned over to the appropriate Regional Committees, with the request that they consider them and pass their comments on to the National Committee. In the absence of a Regional Committee, the principal soil correlator will supply the National Committee with the analysis of this test.

As a result of this study, the 1958 National Committee received data from the Southern States, North Central States, Northeastern States, and Great Plains States. These data were summarized and studied by the National Committee and are appended to this report.

Results of Capability Spot-Check

Two conclusions are immediately apparent from the data. First, capability placements certainly do need more coordination among States; and second, selected phases of well-chosen low families do offer a means of checking class and subclass of capability tables. Such a check not only points out disagreements among capability tables but also raises questions about the low families; thus, the check works both ways.

The data from the Southern States, particularly, show some wide ranges in capability placement. Intentional choices of phases of low families for which capability placements are controversial or difficult account for much of this.

The wide variance in classifying stony soils of the Cecil family is probably due to different degrees of stoniness associated with the concept of stony phase. The IIIs/IVs, IIs/IIIs, and IVs/VIIs classifications of the three Lakeland family units are from Florida and represent classification in the citrus belt, where the soils are very important ones agriculturally, and outside the citrus belt, where they are not. The Captina family unit with B slope and 3 erosion is probably interpreted differently among States with reference to the exposure of or depth to the fragipan. The D slope, 1 erosion, phase of the Captina family is virtually nonexistent and the capability ratings are essentially theoretical or mechanical in origin. The Litz family consists of Lithosolic soils from shales. The eroded phases and especially the shaly and stony phases vary widely within and among the component series, and a considerable range in capability classification was expected, but not so great as was obtained.

One of the most important obstacles in making capability comparisons among States is the variation in slope class ranges. Strict comparisons are not possible if slope classes differ appreciably, as many do, especially for slopes steeper than B. Attempts to make comparisons by fitting the different slope ranges to the nearest comparable ones in an arbitrary standard set of classes would be unsatisfactory because, intentionally or otherwise, the capability placements are based as much or more on meanings attached to the letters A, B, C, D, E, and F, themselves as to the slopes they represent. Thus, for example, if a 10 percent slope of a given soil is classed as a C slope in one State and a D slope in another, the capability classification of the two is very likely to differ. Sometimes the capability placements are more comparable by actual slope ranges, sometimes by letter designations.

Among other possible causes of differences in capability placement are differences in: (1) erosion classes, (2) concepts of component series in the low family, (3) evaluation of soils needing drainage, (4) climate, and (5) effect of local soil associations, agriculture, or economics.

Additional Work of the Committee

In response to a request by the chairman for ideas of further work the committee might undertake, one member suggested that the next step was to develop a uniform set of standard criteria and means of evaluating them for determining capability classes. The committee studied a chart designed by Mr. W. W. Carpenter, SCS State Soil Scientist for Kentucky, to do this for the soils of Kentucky. The committee agreed that the chart has much merit, but that it would need to be revised considerably for general application. Furthermore, the committee agreed that this activity was more properly one for the Committee on Interpretations.

Recommendation

During its six years of existence this committee has: (1) pointed out the relationships between low family and capability unit, (2) shown that phases of low families are useful in constructing capability units, (3) developed a form for obtaining capability data by phases of low families, and (4) shown that spot-checking of capability classes and subclasses of capability tables by means of phases of low families is desirable and feasible. The committee knows of nothing else for it to do at this time on the subject assigned. It recommends, therefore, that it be discharged.

Action of the Conference

The committee report was accepted by the conference. In discussing it, Dr. Kellogg stressed the need for those concerned with the preparation and revision of capability tables and with classifying soils into low families to check the capability placements and low families against each other. Now is an appropriate time to do this in view of the pending revised statement on the capability classification, and the current job of placing series into low families of the 6th Approximation. The more soil surveys are used for such purposes as farm loans and tax assessments, the more urgent the need becomes for capability placements to be consistent from place to place. The only apparent means for accomplishing this is through the low family category. of the soil classification system.

Committee Members:

*W. S. Ligon, Chairman	L. E. Garland	F. F. Riecken
L. J. Bartelli	Fenton Gray	G. H. Robinson
*W. H. Bender	*W. G. Harper	*Roy W. Simonson
W. H. Coates	*W. H. Lyford	M. E. Stephens
*Max J. Edwards	R. M. Marshall	Rudolph Ulrich
R. W. Eikleberry	R. T. Odell	Dirk van der Voet
*D. R. Gardner	*G. A. Quakenbush	B. H. Williams

* Those who participated in committee meetings at the St. Louis Conference.

Results of Sample Testing Capability Classification
by Selected Phases of Low Families

Southern States

Family 1/	Phase	Placement 2/
Cecil	B slope, 3 erosion, non-stony	IIIe(5), IIIe-IVe(1)
Cecil	C slope, 2 erosion, non-stony	IIIe(5), IIIe-IVe(1)
Cecil	C slope, 1 erosion, gravelly or stony:	
	gravelly	IIIe(5), IIIe-IVe(1)
	stony	IIIe(1), IVe(2), VIIe(2)
Lakeland	sand, B slope, 1 erosion	IIIs(3), IVs(3), IIIs/IVs(1), VIs(1)
Lakeland	loamy fine sand, B slope, 1 erosion	IIs(1), IIIs(7), IIs/IIIs(1)
Lakeland	fine sand, C slope, 1 erosion	IIIs(3), IVs(2), IVs/VIIs(1), VIs(1)
Captina	B slope, 3 erosion	IIe(1), IIIe(3), IIIe-IVe(1), VIIe(1)
Captina	C slope, 2 erosion	IIIe(6), IVe-VIe(1)
Captina	D slope, 1 erosion	IIIe-IVe(1), IVe(3), IVe-VIe(2)
Litz	non-stony, C slope, 2 erosion	IIIe(1), IVe(3), IIIe-IVe(1), IIIs-IVs(1), VIs(1)
Litz	stony or shaly, D slope, 1 erosion	IVe-VIe(1), VIe(2), IVs-VIs(1), VIs(1), VIIe(2)
Litz	non-stony, E slope, 1 erosion	VIe(1), VIs-VIIs(1), VIIe(5)

1/ See pages 3 and 4 for list of series in each low family.

2/ The number in parenthesis is the number of States reporting the class and subclass given; two placements separated by a dash thus, IIIe-IVe, means the phase of some series in the family is placed in IIIe and some in IVe; two placements separated by a slant thus, IIIs/IVs, means that the phase of the family is placed in IIIs in one part of the State and IVs in another part.

North Central States

Family	Phase	Placement
Adler	A slope, non-stony, no det. deposit	I(5), I-II(2), II(1)
Adler	B slope, non-stony, 1 erosion	I(1), II(5)
Adler	A slope, non-stony, v. freq. overflow	V(6), VI(2)
Carmi	A slope, 1 erosion	II(6)
Carmi	C slope, 2 erosion	III(6)
Carmi	B slope, 2 erosion	II(6)
Alexandria	B slope, 1 erosion	II(6), II-III(2)
Alexandria	C slope, 3 erosion	III(2), IV(5), III-IV(1)
Alexandria	C slope, 2 erosion	III(6), III-IV(2)

Northeastern States

Family	Phase	Placement
Mardin	B slope, moderately eroded	IIe(3)
Mardin	C slope, moderately eroded	IIIe(3)
Mardin	D slope, uneroded	IVe(3)
Charlton	B slope, moderately eroded, non-stony	IIe(6), IIe-IIIe(1)
Charlton	C slope, moderately eroded, non-stony	IIIe(6), IIIe-IVs(1)
Charlton	B slope, uneroded, stony	IVs(2), VIs(5)
Charlton	D slope, uneroded	VIs(7)
Hagerstown	B slope, moderately eroded, non-stony	IIe(3), IIe-IIIe(1)
Hagerstown	B slope, severely eroded, non-stony	IIIe(4)
Hagerstown	D slope, moderately eroded, non-stony	IVe(4)
Hagerstown	D slope, severely eroded, non-stony	IVe(1), VIe(3)

Great Plains States

Family	Phase	Placement
Bates	A slope, uneroded, non-stony, humid	I-II(2)
Bates	B slope, uneroded, non-stony, sub-humid	II(2)
Bates	B slope, moderately eroded, non-stony, humid	III(2)

Cecil Family

Cecil	Georgeville
Balfour	Hayesville
Bradley	Lockhart
Cataula	Madison
Culpeper	Statesville
Elioak	Surry
Fannin	Tatum
	Wadesboro

Lakeland Family

Lakeland	Independence
Daisy	Izard
Eustis	Kershaw
Evesboro	Wayside
Huckabee	

Captina Family

Captina	Ora
Bedford	Paden
Bolivar	Pearman
Byington	Pickaway
Centerton	Prentiss
Franklinton	Sango
Kenton	Savannah
Lavaca	Sciotoville
Lebanon	Tilden
Mercer	Tilsit
Monongahela	Union
	Zoar

Litz Family

Litz	Pinkston
Eifort	Pottsville
Lehew	Rockcastle
Montevallo	Steekee
Penn	Steinsburg
	Teas

1.440-4
Adler Family

Adler	Huntington
Arenzville	Lindside
Attica	Lobdell
Bold	McPaul
Chagrin	Nedaway
Chaseburg	Orion
Dorchester	Philo
Drury	Pope
Genessee	Sharon
Hamburg	Staser
Haymond	Timula
Haynie	Wilbur

3.530-7
Carmi Family

Carmi	Pana
Fairhaven	Pilot
Griswold	Warsaw
Kasota	Waukegan

6.810-8
Alexandria Family

Alexandria	Lindley
Birkbeck	Miami
Cadmus	Morley
Cardington	Pecatonica
Catawba	Renova
Celina	Russell
Galena	Strawn
Hayden	Wawaka
Kendallville	Westville
	Xenia

2a.47-6.33f
Mardin Family

Mardin	Langford
Culvers	Marilla
Dalton	Mosherville
Ira	Williamson
	Wellsboro

6.33-2a.45
Charlton Family

Charlton	Dutchess
Brookfield	Lenox
Cheshire	Nantucket
Chilmark	Pittsfield
Compton	St. Albans

8.23-7.33
Hagerstown Family

Hagerstown	Duffield
Athol	Elk
Benevola	Frankstown
Collington	Hayter
Conestoga	Hublersburg
	Letort

5.530A
Bates Family

Bates
Burchard
Craig
Geary
Grant
Hall
Hastings
Holdrege
Katemcy
Kipp
Lancaster
Ninnescah
Nuckolls
Peck
Pond Creek
Sharpsburg
Shellabarger
Teller
Vanoss
Westfall

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of Committee on Soil Survey for Forestry Uses

This is the third report of the committee on Soil Survey for Forestry Uses. The original charge in 1955 stated that this committee was to "have broad scope including consideration of use and management interpretations of soils." A listing of our activities is given here:

Activities:

1. Review procedures for planning soil surveys, setting up legends and mapping in forested land.

2. Review methods and devices for interpretation of soil surveys for forestry uses.

3. Encourage collection and use of soil-forest site data.

4. Encourage cooperation of soil scientists, foresters and other professionally trained men in soil survey - forestry work.

5. Promote understanding and use of soil surveys for forestry purposes.

In this report the Committee is giving:

1. Brief review of the 1958 Regional Committee Reports.

2. Summary of findings and actions to date in each of the major activities.

3. Recommendation for the future of this Committee.

Review of 1958 Regional Committee Report.

Committee reports from the North Central, Northeastern, Southern, and Western States were reviewed. The report from the Southern Region is dated October, 1957. The report from the Western Region covers surveys of range and forest lands and is so entitled.

The following statements apply to these four reports:

1. All of the reports except the one from the Southern Conference had attached samples of interpretive tables or narrative for use of soil survey information in forestry. (Individual members of the Southern Committee, however, provided the national committee with samples of interpretive tables.)

2. Other than the attachments the regional committee reports for the most part contain re-statements or elaboration of points covered in the 1957 reports from each of these committees.

3. Committee reports from the North Central States and the Northeastern States indicate that their Forestry Committees will be continued. The Southern and Western Regions state that their committee will be discontinued. In the South the interpretation of soil surveys as they relate to woodland is to be assigned to the Committee on Soil Survey Interpretation. The Western Soil Survey Forestry Committee believes it has accomplished about as much as it can at the present time.

Activities.

1. Planning soil surveys, setting up legends and mapping procedures.

Our 1956 committee report dealt primarily with the planning of soil surveys in forested areas and procedures for such surveys. It set the important premise that basic principles and procedures of Standard Soil Surveys should be followed in making surveys of forested areas. It also stated that kinds of mapping units and the cartographic detail used in a survey of forested land should depend on the physical conditions of the area to be mapped and on the uses to be made of the information.

Regional reports over the past three years reflect adherence to Standard Soil Survey principles for establishing categorical units. The reports also indicate considerable variation in the kinds of mapping units used and in the cartographic detail shown on maps.

Kinds of mapping units were reviewed again at this conference. It appears that soil associations will be used in the mapping of most large wooded areas as in mountains. Where this is the case, sample areas can be mapped in detail using an enlarged scale. These sample areas can serve as a basis for identifying component soils in the soil association units.

Investigations are needed on design of soil surveys in large wooded areas to establish criteria for mapping under various soil conditions.

2. Soil Survey Interpretation for Forestry Use.

During the past year the committee gave special attention to interpretation of soil surveys for forestry use. It assembled tables and other forms of material illustrating interpretations for various forestry purposes. Regional Committees supplied most of these materials including planting guides, tables giving estimated productivity, and tables listing management practices.

All of the samples submitted by the Regional Committees were reviewed and found to have considerable merit. The committee also found that progressive

development is taking place in this field of interpretation and for this reason decided to withhold recommendations on the sample tables. While none of the sample tables are made a part of this report, they were distributed to all members of this committee.

Soil survey maps and related information are tools for making predictions and projecting such predictions to land that has been mapped or to areas where soils have been identified.

Practical ways for presenting this soil survey information in easily understandable fashion are highly important.

Even though much good work has been done as represented by the sample tables mentioned above, there is need for improvement and also additional interpretations. Basic work needs to be done to develop interpretations for items such as timber quality, brush encroachment and disease control.

Both forestry and soil science literature contain many citations on soils-tree growth relations. In some instances the reported observations and data are based on identified soil units - most often tree behavior is reported in relation to one or more soil characteristics. The importance of such information to the understanding of the effect of various factors on tree behavior is not to be minimized. It appears however, that the results of soil-related forestry research would have much wider application if soil units were identified on the experimental areas. All agencies doing such research should be concerned with having soils identified.

3. Soil-forest site data.

The 1956 and 1957 reports of our committee contained statements recognizing the value of soil-site index correlations and encouraged work in this field. The committee, as such, has not undertaken activity in this line of work. It is known, of course, that the SCS is getting into this activity using Administrator's Memo 114 as the basis for operation. The U. S. Forest Service and various State forestry agencies are cooperating with the SCS or operating projects of their own to determine site values. The committee repeats its endorsement of this activity.

4. Cooperation between soil scientists, foresters and others.

This committee continues to urge cooperation between soil scientists, foresters and other scientifically trained men in the field of soil surveys for forestry use. This applies to planning the survey, preparing the legend, conducting the survey, collecting soil site data, and especially to writing interpretations. Regional reports over the past three years contain statements supporting the need for cooperation. This committee believes such statements have had an effect in fostering closer cooperation among those concerned with the work.

5. Understanding of Surveys and Their Uses.

Prior to this meeting our committee had not examined the problems involved in use of soil surveys by an increased number of foresters in operations research or teaching. This is a field which might well be given attention in the future.

The 1958 Western report contained a statement showing that the problem had been examined. The Western statement with slight modifications is made a part of this report. It reads as follows:

"Survey investigations of soils....have hardly started in much of the forest ....areas in the .....U. S. Many of the users or potential users of survey information in these areas have little knowledge of soils, how they are classified and mapped or how the information is interpreted for various specific purposes. Many of these men are eager to learn, and it is important to the proper and full use of survey information that soil scientists take the time to instruct and explain their work for better understanding. In this the soil scientist also stands to benefit from a better understanding of the users' needs.

"The following points are some of the more important ones where experience has shown some confusion or misunderstanding has existed at one time or another:

1. Lack of clear understanding of the difference between soil classification units and soil mapping units; the existence of soil inclusions in mapping (and the composition of undifferentiated units.)

2. Confusion between classification units of the natural system of soil classification (taxonomic units) and behavior or performance classes of soils, such as erodibility classes, fertility classes, or productivity classes.

3. Lack of understanding of soils studied as natural bodies in contrast to soils studied simply as so much material.

4. Lack of full comprehension of the principle that the influence on soil behavior of any one soil characteristic, or a variation in any one, depends on the other soil characteristics in the combination."

Recommendations.

This committee is to be continued, but should be reconstituted so that it can:

1. Work on identification of special problems requiring detailed consideration.

2. Develop means for studying these problems at the field or local level including the assignment of subcommittees or task forces for these purposes.

3. Review the findings and recommendations of such subcommittees and report them to the National Conference.

4. Report other developments of interest to the National Conference.

Note: Examples of jobs for task forces in the Forestry Committee:

1. Development of basic criteria to use in setting up soil mapping units.

2. Development of methods of showing how mapping units can be combined into management units on forest land.

Committee Members:

*A. J. Baur, Chairman	M. A. Fosberg	Paul Lemmon
*A. R. Aandahl	R. A. Gardner	Stanley Locke
H. F. Arneman	L. E. Garland	Harvey Oakes
*D. R. Cawlfield	H. E. Grogger	*T. B. Plair
*R. W. Chapin	J. S. Hardesty	*John Retzer
A. J. Cline	A. H. Hasty	F. T. Ritchie, Jr.
C. E. Deardorff	M. Howard, Jr.	E. L. Stone
Wm. DeYoung	*W. M. Johnson	R. Ulrich
*M. J. Edwards	Marvin Lawson	

*Those who participated in committee meetings at the St. Louis Conference.

DISCUSSION OF REPORT

Kellogg: This topic includes a great number of problems. One of the big questions is how to interpret our soil survey information for the most practical uses in forestry. Forest technology is changing rapidly - we are now in the early stages in forest management practices. Complex problems are ahead. For example, what levels of management will we use in setting up forest site indices? In the South, use of fertilizers and drainage may dictate two or more levels of management. Another problem is the organization of our soil survey information in easily usable form. We have counties, for example, with 150 or more mapping units. These are hard to keep track of and find in a soil survey report. What are we doing to help foresters with the use of our maps?

Klingebiel: We have work on a legend for the soil maps which organizes the the map symbols and points out where the information can be found in the report. We are just getting started on sample areas for this type of legend.

Kellogg: More work needs to be done on design of maps for large forested mountainous areas. This may be a kind of research project to find out the relationship between values to be gained from our maps and the cost of various levels of detail in mapping. A man working on this would be studying the kinds of mapping units, mapping techniques and interpretations.

Plair: In regard to mapping units, we were not thinking of small farm woodlands when we discussed criteria for mapping on forest lands. We need information and criteria on how to set up mapping units on large blocks of forestland in the west and elsewhere. The units should be set up so that we come out with a few management groups for which one can make management recommendations. Criteria for setting up mapping units might be worked out by foresters and soil scientists as part of their regualr operations.

Retzer: Let's recognize that the U. S. Forest Service is a Management Agency. We will have multiple use management. Some uses are complementary, some are conflicting. We manage lands - - not just forest. We must recognize the requirements of all uses including range, timber, wildlife, water and recreation. The ranger must design a management system based on needs of the soil and needs of the management unit. He makes an overall plan first and then makes detailed plans for each use as needed. Soils within the mapping unit will be used as the basis for planning. We are making the soils maps for the long time best use or best suitability of the soils. It must be understood that we are mapping soils - not forests.

Templin: Would it be possible to get the benefit of Mr. Retzer's experience in our area? We would like to have him show us the kinds of legends and other material used by his organization.

Kellogg: These are regular legends and work plans just like the ones with which you are familiar.

Aandahl: Perhaps we can get Mr. Retzer to accompany us in the field on one of our surveys.

Hockensmith: Your committee recommended the appointment of subcommittees or task forces to work on specific problems at the field level. Who appoints these subcommittees and gives them their assignments?

Baur: It is our thought that the committee chairman will make these appointments and assignments. He, with the help of his committee members, should know what various people are doing in the field of soil surveys in forested areas and will thus be in a position to pinpoint activities or problems. He should also be able to select people to report on these things.

Aandahl: This seems a reasonable approach and the committee, if continued, should be guided in this direction.

Johnson: The kind of program we have in mind includes asking selected field men to send the committee legends, instructions and other materials from the field.

Baur: Another possibility is to have progress reports on what the Forest Service and the SCS are doing in various States.

Kellogg: It takes administrative direction and funds for personnel to do special jobs. This will have to be kept in mind as the committee proceeds with its work.

Renner: The need for administrative action will depend on the kinds of activity undertaken. Some of these things can be done in workshops, others by this committee. The Administrator and State Conservationists need to be alerted as to the needs of this Committee.

The committee report was accepted.

Notes by R. W. Chapin.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Committee on Climate in Relation to Soil Classification and Soil Use

A. The committee reviewed the report of the Western Regional committee on Climate. We commend the committee on their work in setting down important problems that need research attention. The National committee recommended to the conference that items numbered 1, 2, 3, 4, 5, and 12 of their report be included in the appropriate State office reports on research needs, submitted by the Service to the Agricultural Research Service. The remainder of the items are considered to be within the scope of the research authority of the Soil Survey. These items are listed and similarly numbered below:

6. Present and past climate as a soil forming factor.

   Research on this should be encouraged, but the lack of techniques makes it a very difficult problem. Certain phases of the problem may receive attention in some of Dr. Ruhe's studies in the Southwest.

7. Defining climatic phases of soil.

   The committee encourages activity on this problem and the submission of proposals for the definition and nomenclature of climatic phases to the Chairman of the National Committee.

8. Yield estimating equations for crops.

   Such equations are especially needed in the dryland farming areas. The work of Mr. Swanson and Mr. Newhall reported below is a step toward this objective.

9. Refinement of climatic zone map for New Mexico.

   Such maps are useful in making soil survey interpretations. A revision might be delayed until further work is done on yield probability estimates.

10. Need for critically evaluating the relationship of certain climatological indices to soil development.

    Generalizations are available, but precise relationships will require very detailed research.

11. Influence of direction and degree of slope and temperature on solar radiation.

    Considerable literature is available in Europe on phases of this subject. There is a critical need for data that will make possible the mathematical expression of these relationships.

B. Mr. Dwight W. Swanson of the World Soil Map group presented to the committee and the conference, "A Method for Estimating Yield Probabilities for Soils on the Great Plains by Using the Gamma Distribution". A summary is attached to this report.

C. The following are projects for committee work during the coming year:

1. Encourage additional work on yield probability estimates. Work to date needs to be reviewed to determine the hazards other than climate; such as insects, disease, etc., that influence yield probability. After these are eliminated, a method or formula needs to be developed to permit the extension of yield probability estimates from limited experiment station data to climatic hazard areas.

   It is specifically suggested that the relationship of climate to yield probability be studied, including the moisture distribution pattern in relation to planting and maturity dates, to see if yield probability might be projected on the basis of climatic data. Local adjustment to be made to evaluate differences in the soil factor.

2. The committee will compile a brief bibliography of literature particularly pertinent to climate in relation to soil classification and use. It is hoped that a brief abstract of the important papers may be included.

3. Attempt to obtain field testing of certain climatic indices such as P-E, moisture index and development units, to determine whether or not these may be helpful in characterizing climatic phases. For example:

   The adjusted potential evapotranspiration values obtained in Thornthwaite's calculations are estimates of solar rediation. These should be more useful than length of frost-free period in describing climatic phases. Such estimates provide a basis for comparison over wide areas.

   Data show that there may be less than 1 percent difference in the number of frost-free days between two areas, but a difference in development units (heat) of 25 to 30 percent.

4. The committee plans to devote effort toward the nomenclature for climatic phases of soils.

5. Encourage investigations on the relationship of soil, vegetation, and micro-climate particularly as determined by differences in aspect. Such studies will be especially helpful in the evaluation of soil-range site relationships.

6. Explore the possibility of getting additional climatic data for important bench mark soils in sections of the country where climatic data are limited.

Committee Members:

*T. B. Hutchings, Chairman	Franklin Newhall	*Guy D. Smith
*L. T. Alexander	H. W. Omodt	M. E. Springer
G. L. Barger	*A. C. Orvedal	*Dwight W. Swanson
*J. E. Dawson	*A. H. Paschall	H. W. Smith
Wendell Johnson	E. Milton Payne	*E. H. Templin
H. J. Maker		

*Those who participated in committee meetings at the St. Louis Conference.

(Over)

An Objective Method of Expressing Yield Probabilities in the Great Plains

Franklin Newhall and Dwight W. Swanson

A method, that exploits long-time yield records, was developed for predicting the probability that crop yields will be above or below any selected level. A total of 42 probability curves were calculated and drawn for some or all of 4 management systems at 13 dryland stations. Each curve sets forth the yield probabilities under a specified management system at the given station and on the particular soil type or phase at this station. Each curve reflects the combined risk in crop production due to weather, insects, diseases and all other hazards.

This method of obtaining yield probability curves assumes that an analysis of a sufficiently long record can be used to predict the probability of getting various sizes of yields in the future. It employs techniques which are routinely used to express climatological risks such as the probability that spring rainfall may be below a certain value or the probability that a freezing temperature may occur before a certain date in autumn. The curves were drawn using the gamma distribution rather than the better known normal distribution because yield data from the drylands area are generally skewed toward low yields and tail out toward high yields; for such skewed data, the gamma distribution provides the better fit. Estimates of the values of the parameters of the gamma distribution, γ and β , are calculated from the observed record. These calculations are only slightly more difficult than those necessary for the computation of the mean and standard deviation of the normal distribution.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Western Regional Soil Survey Conference

LeMoyne Wilson

The Western Regional Technical Work-Planning Conference for Soil Survey was held at the Hotel Newhouse in Salt Lake City, Utah, January 27-31, 1958. This was the fourth year that these annual conferences have been held in this region.

The Soil Survey Work Group, which is a sub-committee of the Western Soil and Water Research Committee, held its annual meeting Monday afternoon, January 27. The principal business of this meeting was the discussion of the Western Regional Soil Association Map Project.

It was generally agreed that each State in the region would prepare a soil association map during 1958 at a scale of 1:1,000,000 for presentation at the 1959 Conference of the Work Group. According to present plans, intra-state differences will be reconciled during 1959, and the regional map plus descriptions of the associations will be published in 1960.

Because of the present lack of soil survey information on broad areas of land in many of the Western States, it will probably be necessary to use information contained in land resource area maps that have recently been prepared by the Soil Conservation Service for the Conservation Needs Inventory. Since these maps are based on vegetation, climate, geology, slope, and erodibility of the soil, we should have some useful information.

Attending the Work Group meeting were most of the State Soil Scientists of the Western States, in addition to the regular Work Group members.

The regular meetings of the Conference started Tuesday morning and continued through Friday. The principal work of the Conference was accomplished by Committees. The subjects are as follows:

1. Criteria for Soil Series, Types, and Phases
2. Soil Survey Maps and Publications
3. Grades of Soil Structure
4. Soil Horizon Nomenclature
5. Soil Classification
6. Soil Survey Research
7. Soil Survey Interpretations
8. Soil Surveys of Range and Forest Land
9. Climate
10. Soil Moisture
11. Improvement in Soil Survey Procedures

Committee reports have been made available to comparable committees, meeting at this conference.

Special guest speakers at the Conference were Dr. Guy D. Smith and Dr. Robert V. Ruhe. Dr. Smith gave an illustrated lecture on "The Soils of the Mediterranean Area" and on the "6th Approximation". Dr. Ruhe gave an illustrated lecture entitled "Landscape Evolution and Soil Development". These talks were informative and I am sure will prove very helpful in our Soil Survey program.

A better understanding of our arid soils is especially needed. This was brought out in the discussion of the committee report on Soil Horizon Nomenclature. Some members of the Committee think that we are not sufficiently informed about surface horizons of arid soils to make significant decisions about their nomenclature.

One of the greatest needs in the West is a comprehensive appraisal of Soil Survey Research needs for each State, and the development of long-range plans for State and regional Soil Survey Research.

A problem that is causing us considerable concern has to do with Soil Surveys of our range lands. There is in many areas a lack of clear understanding of just what is needed. Just how soil scientists and range conservationists can work together to produce a standard soil survey that will give the necessary information for proper range management and will also provide needed information for watershed management, engineering, and other uses, has not been completely worked out.

We have found in Utah that the mountainous range lands are the most difficult areas in the State to make soil surveys, and our best trained and most experienced soil scientists are needed to work in this area.

I believe that there is considerable evidence that the soil survey program is steadily being strengthened in the West. The new classification system is making it necessary to determine more clearly the differentiating characteristics of the soil. We have had to sharpen our powers of observation.

The Experiment Stations in some of the Western States are showing considerably more interest in Soil Survey Research.

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri, March 24 - 29, 1958

Report of the Committee on Engineering Applications of Soil Survey Data

I. Introduction: This Committee did not meet this past year, but it did conduct some business by correspondence. On the basis of this, only one recommendation, but a very important one, is made. This report, in addition to the recommendation, sets forth some developments during the past year in the field of engineering applications of soil survey data.

II. Objectives this year (1958):

A. To evaluate the outline, which was proposed a year ago for the chapter on engineering applications for soil survey reports.

B. To consider the March 7, 1958, recommendations of the SCS Engineering Division's Committee on Correlation of Engineering and Soils Data.

C. To suggest problems, if any, that the Soil Survey Committee should deal with next year.

III. The March 7, 1958, report of the SCS Engineering Division's Committee on Correlation of Engineering and Soils Data.

A. This Committee met during the week of March 3-7, 1958, and revised the year-old set of recommendations for the chapter on engineering applications for soil survey reports. Every engineer on this Committee, during the past year, had participated in the writing of at least one engineering chapter. Mr. Preston C. Smith of the Bureau of Public Roads, who has participated in writing many chapters, also met with this Committee as did Arnold C. Orvedal of the Soil Survey, SCS. In addition, the principal correlators for interpretation met with this Committee during parts of two days.

1. The SCS Engineering Division's Committee also considered the following items:

a. Comments from members of the Soil Survey National Committee on Engineering Applications of Soil Survey Data.

b. Report of North Central Soil Survey Committee on Engineering Applications, January 20-24, 1958.

c. Report of Northeastern Soil Survey Committee on Engineering Applications, January 27-28, 1958.

d. Suggestions made by the Highway Research Board's Committee on Surveying, Mapping, and Classification of Soils, January 6, 1958.

2. The recommendations of the Engineering Division's Committee, therefore, reflect constructive influences from many sources.

IV. RECOMMENDATION:

A. The Soil Survey Committee on Engineering Applications of Soil Survey Data concurs in the recommendations of the March 7 report of the SCS Engineering Division's Committee on Correlation of Engineering and Soils Data with the recognition that some minor clarifications are needed and recommends that this Conference accept the March 7 report with this qualification.

V. Other Information:

A. Status of cooperative research with the Bureau of Public Roads.

1. This cooperative research is continuing.

2. BPR has received samples from 94 counties, representing 37 States and Alaska.

3. BPR has completed laboratory tests on samples from 80 of these counties.

4. BPR has participated in the writing of 17 engineering chapters for soil survey reports. In fact, BPR has done most of the work on these chapters.

5. Mr. Preston C. Smith of BPR has participated in 20 conferences involving BPR, State SCS, and State highway department personnel. These conferences have dealt mainly with the writing of the first engineering chapter in each State. Mr. Smith is now on a trip on which 10 more such conferences will be held.

6. BPR is inviting some State highway departments to do the laboratory testing in lieu of the BPR; such work is being arranged for and monitored by the BPR.

B. Training:

1. The need for training in elementary soil engineering is widely recognized, and some progress is being made.

a. A series of one-day training conferences for State conservation engineers and State soil scientists is being conducted. Two such conferences have already been held; several others are scheduled. These are being held in conjunction with other conferences for engineers conducted by the Engineering and Watershed Planning Units. While the one-day training conferences are beneficial, the general consensus at the two conferences already held is that considerably more training is needed.

b. Some training has accrued from the State conferences led by Preston C. Smith of BPR (See par. V A5).

c. The North Central Regional Committee proposed that A. C. Orvedal, R. S. Decker, and P. C. Smith prepare an outline on engineering properties of soils and added that "this should cover briefly the engineering properties and tests that a soil survey party chief should be familiar with and also something on their significance and importance." With this material as a guide, the North Central Committee suggests that a definite training program for soil scientists should be set up. (As a substitute for this outline, Orvedal suggests the "PCA Primer", published in 1956 by the Portland Cement Association, 23 West Grand Avenue, Chicago 10, Illinois. The PCA fills requests for these primers without charge.)

C. Alternative publication.

1. The North Central Committee suggests study of the desirability of publishing for areas larger than a county the engineering information now being included in county soil survey reports. It is implied that the engineering chapter could then be omitted from the soil survey reports. Similar suggestions have been received from other sources. In response to such suggestions some reasons for including the chapter in county soil survey reports have been set forth. Among these are:

a. The engineering chapter "rounds out" the soil survey report; this makes it a rather complete package of soil information for the county. Neither an engineering chapter in the soil survey report nor a substitute publication outside of the report will contain all the information about soils that engineers and others find useful. To have engineering information, detailed soil survey information, and the county soil map in one publication is mutually beneficial to engineers and many other users of county soil surveys.

D. Highway Research Board's Committee on Surveying, Mapping and Classification of Soils.

1. This Committee met on January 6, 1958. Among the items discussed was the engineering chapter for soil survey reports. Suggestions made there were later considered by the SCS Engineering Division's Committee and most of them were adopted. Only two of the observations are repeated here.

a. To have the predominant clay minerals given, not necessarily in the engineering chapter but somewhere in the report, would be useful. Research is revealing the importance of kinds of clay minerals to engineering.

b. The inclusion of block diagrams, not necessarily in the engineering chapter but somewhere in the report, was strongly favored. These diagrams, perhaps more than any other device, help engineers to understand our soil maps, and they also serve as effective keys for those who want to identify soils in the field.

E. Problems that still need to be dealt with.

1. There are some minor ambiguities in the recommendations of the SCS Engineering Division's Committee report of March 7 that need to be clarified.

2. There are some problems dealing with the classification of soils according to the "Unified" system.

3. The problem of training, while well recognized, is not completely solved.

VI. Committee Continuation:

A. No recommendation is made regarding continuation or termination of the Soil Survey Committee on Engineering Applications of Soil Survey Data, but an observation is submitted that the principal mission of this Committee has been accomplished.

Committee Members:

*Arnold C. Orvedal, Chairman	L. F. Lawhon	A. S. Robertson
*James S. Allen	John Maletic	I. F. Schneider
W. H. Coates	Frank R. Olmstead	Preston C. Smith
C. J. Francis	G. G. Pohlman	Dirk van der Voet

*Those who participated in committee meetings at the St. Louis Conference.

Comments on Committee Report

Mr. Templin asserted that soil structure grade (degree of distinctness and durability) as well as soil structure type (shape and arrangement of peds) needs to be recorded in Col. 14, Table 1; otherwise the information will be meaningless. In response to a question, Orvedal indicated that information on structure was used by engineers for interpreting something about permeability, and Dr. Kellogg added that soil structure also was of importance in soil compaction. Mr. Johnson noted that to interpret permeability from soil structure is difficult and asked if information on soil consistence would not be more useful for this purpose.

Forrest Steele asked what terms should be used to express shrink-swell potential in Column 19, Table 1. Orvedal replied that while the need for quantitative

classes was recognized there is not enough information available to establish such classes. The best that can be done for a while is to use the recommended qualitative terms of low, moderate, high, and very high, with Houston clay and Fargo clay as reference soils that are considered to have a very high shrink-swell potential. These terms at least indicate the relative potential and to know which soils have high or very high potentials is quite important to engineering. Mr. Templin added that some clays in Texas increase in volume more than 100 percent upon wetting.

Mr. Templin asked if the terminology in Column 5, Table 1, should not be soil science terminology rather than engineering terminology. Orvedal replied that where conflicting terminology existed, he believed that soil science terminology should be used.

Mr. Blakely asked if there were not several soil map units in the example set forth in Table 1. Orvedal replied that in this particular example, there are 10 map units accommodated by one description. The table is intentionally designed so as to meet two requirements. The first is to list all map units, arranged alphabetically according to symbol. This arrangement is considered essential to easy reference from the map to the table. The second is to permit such grouping for descriptive purposes as is possible under the first requirement. In this particular example, one description and one set of estimated properties suffices for all ten map units, except for information on slope but this is given in the soil name. Orvedal added that the design of the table is such that one description can be used for one group of members of a series, and a different description for another group, if that should be necessary.

Dr. Gardner pointed out that in Rockingham County, for example, there might be other soil series similar for engineering purposes to the Charlton series. If so, would there not be an advantage to grouping such series together. Orvedal acknowledged such an advantage but added that to have the soils arranged alphabetically by soil symbol was more important. Some duplication of descriptive material perhaps can be avoided by stating for members of series D, for example, that the soils are like those of series B.

Dr. Gardner asked what was intended for Column 1 in Table 2. Orvedal answered that this column, like the corresponding column in Table 1, should contain the map symbols arranged alphabetically. In addition, it should contain the series name (but not the complete set of map unit names). He also called attention to the fact that the sample interpretations in Table 2 were not for the same soil series used in Table 1.

Mr. Orvedal pointed out, in response to a question from Mr. Johnson, that the items indicated by the column headings, particularly in Table 2, should be adjusted to cover those significant in the county in question and to items about which information can be given with confidence. Mr. Templin added that in Table 2, Column 14, entitled "Irrigation", might be expanded to several columns in counties with much irrigation, and Dr. Smith added that additional columns to set forth interpretations regarding land leveling might also be included for such counties.

Someone added that interpretations for domestic sewage disposal systems could be made for counties with expanding urban developments.

Dr. Kellogg suggested that interpretations on corrosion should be included and called attention to a comprehensive publication on this subject. This publication is Bureau of Standards Circular C450, entitled "Underground Corrosion". It was published November 27, 1945, and is for sale by the Superintendent of Documents for $1.25.

Mr. Allen asked about the meaning of "topsoil". Dr. Kellogg replied that as used here it means soil material used to top-dress road banks, ditch banks, and the like, and added that such use was consistent with the Soil Survey Manual.

Dr. Kellogg then made some concluding remarks. In regard to training he expressed the hope that the State soil scientists and State conservation engineers would gain enough information from the one-day training conferences to lead the work in their States. In regard to the development of engineering chapters he hoped that engineers, both SCS and highway engineers, would cooperate. Many engineers already have been very helpful. Great benefit stands to be gained from getting participation by local engineers. Dr. Kellogg also noted that there is some sentiment in favor of publishing engineering information for areas larger than counties instead of having an engineering chapter in the soil survey reports. He expressed disapproval of such substitute publications. Engineering information would then become separated from the soil maps, and separated from the maps it would have but little value.

CONFERENCE ACTION: The Conference accepted the report with the following qualifications:

1. That some clarification is needed in the recommendations and examples contained in the March 7, 1958, report of the SCS Engineering Division's Committee on Correlation of Engineering and Soils Data.

2. That Column 14, with the heading "Structure" in Table 1 of the report just cited, either be omitted or that the recommendation regarding its content be modified to include grade as well as type of structure.

Report of SCS Engineering Division Committee on "Correlation of Engineering and Soils Data", March 7, 1958

Recommendations:

1. Engineering chapter of soil survey reports should consist of tables and narrative similar to examples contained in this report.

2. Preparation of chapter at field level by soil scientists and engineers familiar with conditions in area covered by survey report.

3. Adequate training program be provided on preparation of narrative and tables, including recognition and determination of soil features.

OUTLINE OF MATERIAL TO BE INCLUDED

A. Scope and limitations

1. Introductory statement.

2. Statement of limitations on applicability and use of information in section. It is not intended that this report will eliminate the need for sampling and testing for design and construction of specific engineering works.

3. Information in the report can be used to:

a. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.

b. Make preliminary estimates of the engineering properties of soils in the planning of agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.

c. Make preliminary evaluations of soil and ground conditions that will aid in selecting highway and airport locations and in planning detailed investigations of the selected locations.

d. Locate probable sources of gravel and other construction materials.

e. Correlate performance of engineering structures with soil mapping units and thus develop information that will be useful in designing and maintaining the structures.

f. Determine the suitability of soil units for cross-country movements of vehicles and construction equipment.

g. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.

h. To develop other preliminary estimates for construction purposes pertinent to the particular area.

B. Soil Science Terminology

All soil science terms which may have a significance in engineering should be listed and defined either in glossary or in this portion of the engineering section. This section should include the outstanding examples of soil science terms that may have different meanings in other fields. Some of these are: soil, sand, silt, clay, gravel, topsoil, subsoil, soil type, aggregate, well graded, poorly graded.

C. Explanation of Tables

Narrative statements to clarify the meaning of the items as tabulated in the tables. As examples in Table 1 the items of permeability, available water-holding capacity, and shrink-swell potential may have explanations similar to the following:

"Permeability of the soil material was estimated for the soil material as it occurs without compaction. The estimates were based on soil structure (after the method developed by Alfred O'Neill) and compared with undisturbed core permeability tests made on similar soil material."

"The available water in inches per foot of soil depth is an approximation of the capillary water in the soil when wet to field capacity. When the soil is "air dry" this amount of water will wet the soil material described to a depth of one foot without deeper percolation."

"The shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content."

D. Brief description of the soils of the survey area and their estimated physical properties. (Table 1 - see sample)

E. Engineering Interpretation of the soils of the survey area.

(Table 2 - see sample)

F. Tabulations of test data.

Test data to be organized in tables compatible with the volume and types of data available.

G. A short narrative section covering general soil conditions, unusual site factors, problem areas or other features of the survey area may be necessary to supplement information given in the tables.

Instructions for Table 1.

Table 1 includes the listing of soil mapping units with a brief description of the soil series characteristics and estimates of some of the physical properties affecting engineering work.

Column 1 -- All map unit symbols would be listed alphabetically.

Column 2 -- Map unit name for each symbol listed in column 1.

Columns 3 and 4 -- Columns for depth to water table, depth to bedrock and others may be excluded if not significant in the survey area. When such characteristics are significant in minor areas only, they can be covered in the soil site description or elsewhere.

Column 5 -- Brief site and soil description. Descriptions should be brief; and they should be for engineers. Information about fertility, details about color, and other details of little or no obvious value to engineering should be omitted. On the other hand, information of obvious value to engineers should be included; and should cover the following items:

Topographic positions	
Slope range - unless covered in soil name.	Included variations
General soil profile	Stoniness
Parent Material	Depth to water table. Unless covered in Col. 3.
Substrata	Stability of natural slopes (landslides, subsidence)
Total depth to bedrock. Unless covered in Col. 4	Natural seepage characteristics as they affect landslides, internal erosion or movement of soil materials

It is not likely that all these items will be needed to adequately describe any one series; and in some cases, items not listed may need to be covered.

Column 6 -- The typical profile description to which properties are assigned should be the profile description in the body of the report. Actual depth figures to which profiles have been studied should be shown in this column.

Columns 7, 8, and 9 -- Self-explanatory. (See references)

Columns 10, 11, and 12 -- Grain-size distribution shown in these columns should be given as a range of values. The range will usually cover a spread of at least 10 percent but may be more or less. The values given should represent the dominant conditions for the material described. If any of the columns are not needed due to uniformity of soils in a survey area they may be eliminated.

Column 13 -- Permeability relates only to movement of water through undisturbed materials. These values should be expressed in terms of inches per hour. The basis for estimating permeability should be stated.

Column 14 -- Soil structure should be given in terms of type to include platy, prismatic, columnar, blocky, granular, crumb. If there is no observable structure use the terms massive or single-grain.

Column 15 -- Available moisture should be expressed in inches of water per foot of soil being evaluated. Values assigned to this characteristic shall be limited to those considered reliable.

Column 16 -- pH should be shown as a numerical range. When pH is expressed in adjective terms in soil descriptions these terms should be converted to numerical values.

Column 17 -- Salinity should be expressed as a range in percentage. This column should be omitted where salinity is not significant to engineering practices.

Column 18 -- Dispersion refers to the degree and rapidity with which soil structure breaks down or slakes in water. High dispersion means that the soil slakes readily.

Dispersion is expressed in terms of high, moderate, and low.

Column 19 -- Shrink-swell potential refers to the volume change of soil when subjected to changes in mositure. Shrink-swell potential should be expressed as low, moderate, high and very high.

In general, soils classed as CH or A7 have high or very high shrink-swell potentials. Typical examples of soils series with very high volume change characteristics are Houston clay and Fargo Clay.

Table 2

Table 2 sets forth specific features or characteristics found within the profiles of all series that may affect the selection design and/or application of treatment measures. These features are specified and evaluated on the basis of estimated data from Table 1, actual test data available, and field experience and performance.

Practices included in Table 2 will be those common to the survey area. Practices set forth in the example are intended as a guide and should be modified to fit the needs and problems of the area.

In general, rating terms such as good, fair, poor or unsuitable will be used in describing the suitability or adaptability of material for various uses. Such terms should not be used to describe soil features affecting engineering practices.

If practices for which spaces are shown are not applicable to a particular soil or soils in the survey area or available information is not adequate to formulate conclusions the space should be left blank except for footnote reference. Footnote should explain reasons space was left blank.

Table 3

Table 3 should set forth test data available from the Bureau of Public Roads. Other spurces of data such as state highway laboratories, soil survey laboratories, state experiment station laboratories and others should be investigated and utilized to gather information on such items as:

1. Grain-size distribution.
2. Liquid limits.
3. Plasticity index.
4. Maximum density.
5. Optimum moisture percentage for compaction.
6. Moisture tension.
7. Dispersion percentage.
8. Percent salinity based on 1 to 5 solution.
9. Chemical analysis of soil extract.
10. Conductivity of saturation extract.
11. Resistance of soil paste.
12. Bulk density or valume weight.
13. Percent swell upon wetting.
14. Pressure potential from wetting.
15. Permeability of core samples of major soil horizons.
16. Cylinder infiltrometer or other types of infiltrometers.
17. Available moisture percentage.

In addition to the above it is thought that when the data was put into tables it would be desirable that both the Unified and the A.A.S.H.O. designation be given if they could be determined from the test data available.

Attachments - Tables 1 and 2

References for Classification Systems

"The Unified Soil Classification System" Technical Memorandum No. 3-357, Corps of Engineers, U.S. Army with Appendix A and Appendix B.

"Standard Specifications for Highway Materials and Methods of Sampling and Testing", adopted by the American Association of State Highway Officials, AASHO Designation: M 145-49

"Soil Survey Manual" (U.S. Dept. of Agriculture Handbook No. 18 by Soil Survey Staff.

"PCA Soil Primer" by Portland Cement Association, 1956

TABLE 1.--Brief Description of Soils of Rockingham County, New Hampshire, and Their Estimated Physical Properties

Symbol on map (1)	Soil name (2)	Depth to seasonally high water table (3)	Depth to bedrock (4)	Brief site and soil description (5)	Depth from surface (Typical profile) (6)	Classification: USDA Texture (7)	Classification: Unified (8)	Classification: AASHO (9)	Percentage passing: #200 sieve (10)	Percentage passing: #10 sieve (11)	Percentage passing: #4 sieve (12)	Permeability (13)	Structure (14)	Available water (15)	Reaction (16)	Salinity (17)	Dispersion (18)	Shrink-swell potential (19)
		Feet	Feet		Inches							Inches per hour		Inches per foot of depth	pH Value	Percent		
Ca Cb Cc Cd Ce Cf Cg Ch Ck Cm	Charlton loam, 0-3% " " 3-15% " " 3-8% " " 8-15% " " 15-25% " " 25-35% " stony loam, 0-15% " " " 0-8% " " " 8-15% " " " 15-25%	3 +	1/	2 to 2-1/2 feet of well drained sandy clay developed from glacial till that is mainly sandy silt or gravelly silt derived principally from mica, schist and phyllite. Stones and boulders in subsoil and substratum. In the stony phase, stones and boulders occur on the surface.	0 to 24		SM	A_2 A_4 or A5	25 to 40	55 to 75	60 to 80	.8 to 2.5	Granular		5.1 to 5.5			Moderate to low
					24 to 36		SM or GM	A_1 or A_2	25 to 35	55 to 70	60 to 75	.8 to 2.5	Platy		5.1 to 5.5			Low

1/ Undulating character of bedrock makes any estimates of depth unreliable. Generally bedrock under these soils occurs below a depth of 5 feet.

TABLE 2.--Engineering Interpretation of Soils in ____________ County

Soil series and map symbol (1)	Adaptability to winter grading (2)	Susceptibility to frost action (3)	Suitability of Soil Material for - Road subgrade (4)	Suitability of Soil Material for - Road fill (5)	Suitability as Source of - Topsoil (6)	Suitability as Source of - Sand and gravel (7)	Soil Features Affecting Engineering Practices: Vertical alignment for highways - Materials (8)	Vertical alignment for highways - Drainage (9)	Dikes or levees (10)	Farm ponds - Reservoir area (11)	Farm ponds - Embankment (12)	Agricultural drainage (13)	Irrigation (14)	Terraces and Diversions (15)	Waterways (16)	Remarks (17)
X-Soil Aa, Ab, Ac, Ad, Ae	Poor due to high water table	Non-susceptible to moderately susceptible	Good	Good with gentle slopes easily eroded	Surface layer is fair	Poorly graded, fine sands but probably too wet for use in natural state	---	Seasonal high water table	Susceptible to piping	Excessive seepage	Adequate strength and stability; moderately permeable	Seasonally high water table. Permeability good. Fine sand below 24 inches	Low water holding capacity	Highly erodible	Highly erodible	---

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service

NATIONAL TECHNICAL WORK-PLANNING CONFERENCE OF THE COOPERATIVE SOIL SURVEY
St. Louis, Missouri 24 - 29, 1958

Report of the Committee on Classification of Organic Soils

The objectives of the committee were to prepare identification sheets dealing with organic soil materials and to prepare a model organic soil series description as a guide to those who will be describing soil series in field trials of the scheme recommended for trial by the 1957 Conference.

A preliminary description of organic soil materials was prepared and attached to the 1957 Committee Report. It was revised and used in the field by Ligon, Hasty, and Dawson in Florida and Georgia. It was also used in the field by Lytle, Lawson, Fontenot, and Dawson in Louisiana. It was also used as a basis for writing an organic soil series description. This description was circulated for criticism. Criticism of this series description indicated that a sharp distinction needed to be made between an horizon and a layer of organic soil material. It also indicated that a minimum number of kinds of horizons should be used. With these points in mind a proposal dealing with "Master Horizons Occurring in Organic Soils" was prepared by the Chairman for distribution to the committee and to the members of the 1958 Conference. This proposal (copy attached) involved four kinds of horizons. One kind was dominated by identifiable dead plant materials. A second kind was dominated by small particles not showing plant structures. The material of this kind of horizon has a relatively low exchange capacity and content of brown acids soluble in sodium pyrophosphate. A third kind included muck layers as previously defined by the National Conference (1956). A fourth kind included layers in which mineral matter dominates the dry sample, c.f. marl, diatoms and/or mineral soil.

It was reported that field mapping trials using the 5th Approximation scheme for classifying organic soils as modified by the 1957 conference had not been made.

The report of the Organic Soils Committee of the North Central Technical Workshop of the Cooperative Soil Survey was reviewed briefly. Excerpts from this report follow.

"Many of the committee members* felt that the higher categories (VI and V) of the 1957 National Committee report were not satisfactory because of practical considerations (See 1957 Regional Report)". The pertinent material from this 1957 report follows. "The above two groups** are essentially used to separate peats containing layers formed by a lake-fill process from those formed by a

* North Central, 1958
** Category VI of the 5th Approximation

build-up on wet land. This tells us the mode of origin of the peat solum. In Minnesota this kind of separation on deep peats would not be practical for two reasons. First, it would be almost a cartographic impossibility to separate areas containing a layer of sedimentary peat from those lacking it. This is due to the complexity of the formation process". --- "For example, the large, peat-covered glacial lake beds in northern Minnesota have very uneven post-Pleistocene lacustrine surfaces. When the greater part of these glacial lakes dried there were many very small and a few large depressions which remained as lakes. These filled with aquatic peat (sedimentary) first and subsequently the entire glacial lake basin was "blanketed" by herbaceous (fibrous) peat or moss peat". --- "Secondly, I wonder about the importance placed on the presence or absence of an aquatic (sedimentary)peat in a deep peat solum. I particularly question this where there is a thick layer (3 to 10 feet) of herbaceous (fibrous) peat or moss peat overlying the sedimentary layer. Are we placing the emphasis where it should be?" The objections of many members of the North Central Committee can be summarized by two questions. First, can the 5th Approximation as amended in 1957 be applied at a reasonable cost? Second, should organic soils be investigated to the bottom?

It was pointed out that the answer to the first question will remain an opinion until field personnel try mapping soils by the proposed scheme. Time studies will be an important part of such trials as they are made. Furthermore, these trials should include a suitable variety of organic soils and a suitable variety in levels of generalization of mapping units. Several persons consulted regarding the first question raised by the North Central Committee about mapping large areas of organic soils expressed the opinion that mapping intensively cultivated organic soils is to mapping non-agricultural organic soils as mapping irrigated areas is to mapping dry land farming areas in the Great Plains. Several persons also expressed the idea that non-agricultural areas of organic soils may be mapped as are steep stony mineral soils, c.f. low family units could be mapped on areas of soil undifferentiated at Categories VI, V and IV.

The second question was discussed at length by the 1957 National Committee and is included in the report of that committee. New work pertinent to this question was presented to the 1958 Conference and is attached to this report as Figures 1, 2, and 3. The data in Figures 1 and 2 show that when water flows downward from a very finely divided organic soil material into an inorganic basal layer like diatomaceous earth, marl or heavy textured mineral soil the pressure drop across the interface controls the rate of flow. Two pressures were used in each system as indicated by the points in the portion of the column marked "liquid". The hydraulic conductivities of the two materials above and below the interface are relatively unimportant compared to the control exerted by the interface produced by each pair of materials. Furthermore, a single sedimentary peat over diatomaceous earth interface would exert as much effect on downward movement of water as would the hydraulic conductivity of roughly 100 feet of sedimentary peat, the material of lowest hydraulic conductivity in the strictly organic portion of an organic soil profile. The hydraulic conductivity of an interface varies greatly with the materials involved, c.f. a muck over diatomaceous earth interface is around 2 orders of magnitude higher in hydraulic conductivity than a sedimentary peat over diatomaceous earth interface. Figure 3 shows that the hydraulic conductivity of a

relatively permeable material like diatomaceous earth exerts more control over downward movement of water in a column of disintegrated peat over diatomaceous earth than does the interface between these two materials. These data as a whole indicate that both basal layers, the kinds of layers and the arrangement of these layers within a profile can have large effects on water movements in these soils.

The North Central Committee Report also contained the following statements. "Some felt that there doesn't appear to be any relationship between kinds of basal layers and kinds of organic material in other layers in the profile. -- For example, a given organic solum composed principally of a fibrous type (herb) peat layer near enough to the surface and thick enough to be very significant both from a genetic as well as a use standpoint may contain any one of several different kinds of basal layers."-- Table 1 of the 1957 National Report covered this point, but this question from the North Central Committee indicates that an explanation of the situation is in order. Assume that the data presented in this table is a reliable sample of organic soils. First, throw out all profiles in which the first layer above the basal layer is anything other than fibrous peat or sedimentary peat overlain by fibrous peat; do this job by calculation from the data in the table. These thirty-nine profiles containing fibrous layers have basal layers of Marl, diatomaceous earth and sedimentary peat in 18 percent, 13 percent and 69 percent, respectively, of the profiles involved. On the other hand, if all 59 profiles are regarded from the bottom up, these profiles consist of one of the following sequences, marl under sedimentary peat under fibrous peat, or diatomaceous earth under sedimentary peat under fibrous peat, or sedimentary peat under fibrous peat except one profile which consists of sedimentary peat under moss peat and 12 profiles truncated by premature drainage which produced muck layers. The point is that soil profiles should be regarded in the direction in which they are formed (c.f. mineral soils from the top down and organic soils from the bottom up), if order is to be recognized in the sequence of horizons observed in the profile.

The North Central Committee also assembled a variety of proposed schemes for classification of organic soils. Nine such proposals were attached to their report which was forwarded to the National Committee for criticism. Two replies were received by the Chairman of the National Committee. In view of this situation and the fact that the Committee did not meet, action on these proposals was not taken.

In 1956 several profiles were sampled for a botanical study by Dr. George B. Rigg of identifiable materials especially in fibrous and sedimentary peats. One of the main purposes of this study was to determine whether or not the finely divided material in fibrous peats was different from similar material in sedimentary peat. The work failed to answer this question, but it showed that sedimentary peat is fecal material and that the portion of so-called fibrous peat that is identifiable material was very small in all 7 profiles sampled. In 1957 a chemical study of this problem was initiated. Table 1 and figures 4, 5 and 6 contain some of the data that have been obtained. If it is assumed that the carboxyl groups which give rise to the "strong acid*" exchange capacity are produced by oxidation of plant materials, it follows from the data of table 1 that both disintegrated peat and sedimentary peat are intermediate

*This does not include such weak acids as phenolic OH groups.

between fresh plant materials and muck. This is part of the justification for the master horizon proposal attached to this report. It covers horizons of kinds (I), (II) and (III). It also follows that the pyrophosphate test for muck reliably identifies the highly oxidized layers in organic soils.

The data in figures 4, 5, and 6 show the final distribution of color, organic matter and polysaccharide from 2.0 ml. of a sodium pyrophosphate extract of an organic soil initially placed in a tube of buffer at 0.0 ± 1.0 ml. of buffer after exposure to an electric field for about 16 hours. The colored acid observed in muck, figure 4, is the substance measured in the pyrophosphate test. The disintegrated peat for which data are presented contains this acidic substance, but in much smaller amount. The sedimentary peat for which data are presented did not contain this acidic substance. Both of the above peats did contain another non-acidic and non-basic brown material not found in the muck. Since none of the three mucks examined to date have contained this non-charged brown material, it looks as though the pyrophosphate test value selected for definition of muck is about right from this point of view. A similar statement can be made regarding the basic material observed in the organic matter pattern, figure 5. The polysaccharide pattern, figure 6, shows a striking difference between disintegrated peat and sedimentary peat. From these data alone it is obvious that disintegrated peat could be a mixture of muck and sedimentary peat. The difference in flow of water through columns of these two materials over diatomaceous earth is so great that they should be separated even if the above were true.

The discussion that followed the report involved several points covered by the formal report that were not reported to the conference. Where this discussion did not add new ideas, facts or objections it has been deleted from the following summary of discussion.

Committee Members:

*J. E. Dawson, Chairman	E. G. Knox	*W. S. Ligon
C. E. Engberg	Marvin Lawson	*W. H. Lyford
R. S. Farnham	G. B. Lee	O. C. Rogers
D. F. Fontenot	O. C. Lewis	F. E. Schlotz
A. H. Hasty		

*Those who participated in committee meetings at the St. Louis Conference.

Discussion:

Kellogg: Volcanic ash layers occur commonly in peats in Iceland. Thus D horizons may occur under the organic layers of a profile, between two such layers or within a single such layer.

The new classification scheme must be listed in the field. It must be listed broadly. Consideration should be given to mapping a sample area, say a section or two, in detail where there is a need for mapping large areas of non-agricultural soils using broad mapping units.

Dawson, Smith and the Principal Correlators should work out procedures and arrangements for field testing organic soil classification scheme this summer. A discussion of possible test-areas followed. Suggestions were made regarding possible areas in North Carolina, New York and Washington States.

Where do Kattekleis fall in the new system?

Dawson: They, i.e., organic soils of comparable sulfur and/or sulfide contents, are separated at the low family level.

Ulrich: What is significance of deep vs shallow organic soils?

Dawson: Drained organic soils subside, that is the elevation of the surface decreases with time. When they become shallow they may be excessively wet in years of high rainfall and excessively dry in years of low rainfall. The depth of soil separating shallow soils from deep soils at the low family level has been selected so as to allow a reasonable period of good production in which to recover investments in drainage, land clearing, etc., before production becomes seriously affected by the moisture problems mentioned above.

Kellogg: Overdraining an organic soil is a serious mistake. It may explain why organic soils in Wisconsin are considered drouthy. With proposed classification could hydraulic conductivity be predicted?

Dawson: The problem is very complicated because hydraulic conductivities of both materials and of interfaces between kinds of materials would have to be considered. There is a fair possibility that reasonable estimates could be made.

Dawson: About three-fourths of the unproductive areas of organic soil in New York State are inherently unproductive and should not have been drained. The causes of the inherent low productivity of these areas are covered quite well by the new system and especially by the low family groups. It is very important that the system we adopt provide a basis for recognizing such unproductive areas of organic soil both in cultivated fields and in areas being considered for drainage.

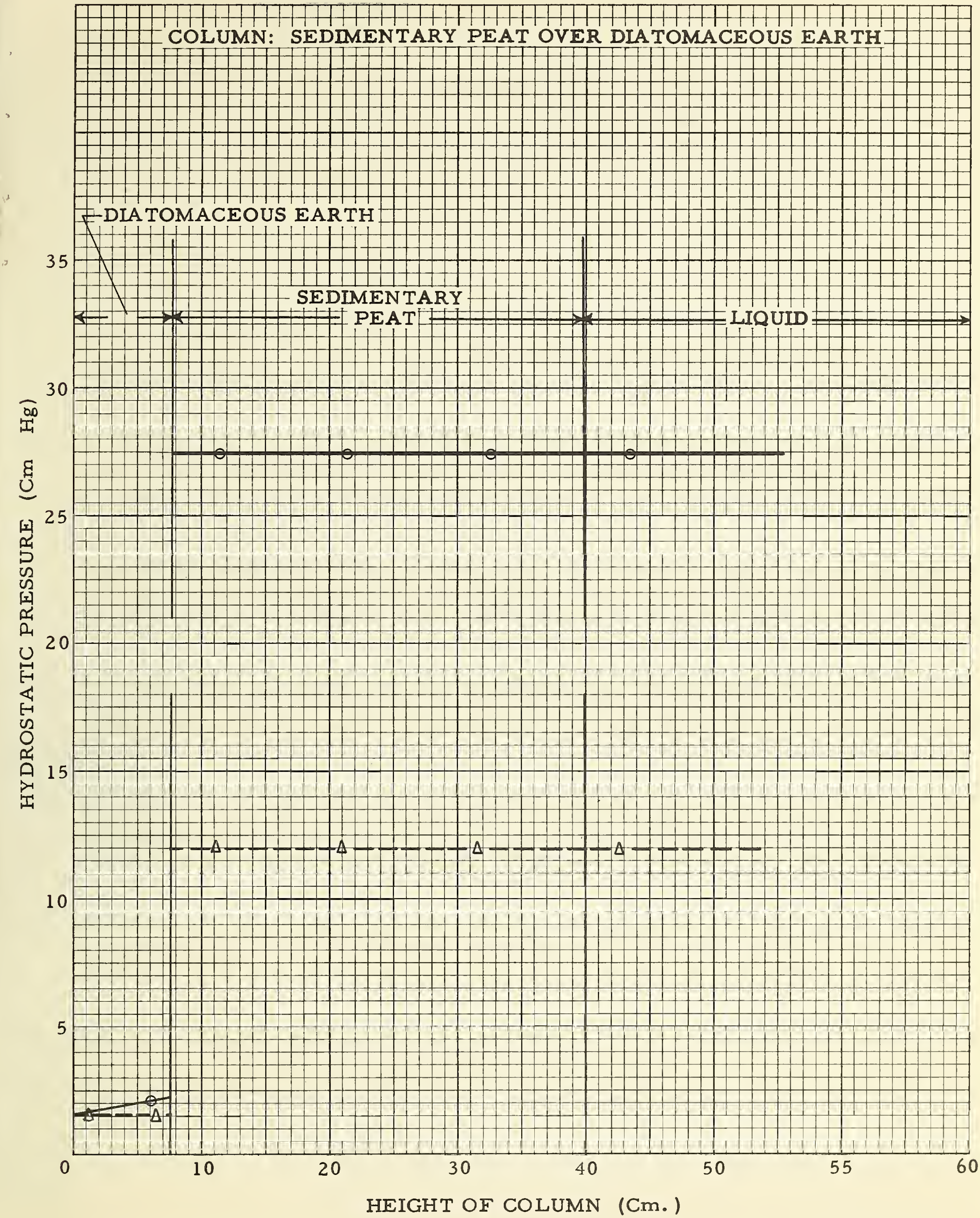
Table 1. Exchange Capacity of Organic Soil Materials

Material	Exchange Capacity m.e./100g. of organic matter-"Strong acid" group.*	Organic matter percent of weight at 70° C.	Pyrophosphate test for muck
Muck	295 ± 1	87.15%	2%
Muck	277 ± 5	70.31%	2%
Muck	240 ± 2	73.6%	2%
Muck	374 ± 7	81.8%	2%
Disintegrated Peat	168 ± 1	54.40%	1/4%
Disintegrated Peat	153 ± 2	85.46%	1/4%
Sedimentary Peat	97 ± 2	69.05	1/4%
Sedimentary Peat	140 ± 6**	19.05	1/4%

* See 1957 National Report, figure 1, for an explanation of these exchange capacity values.

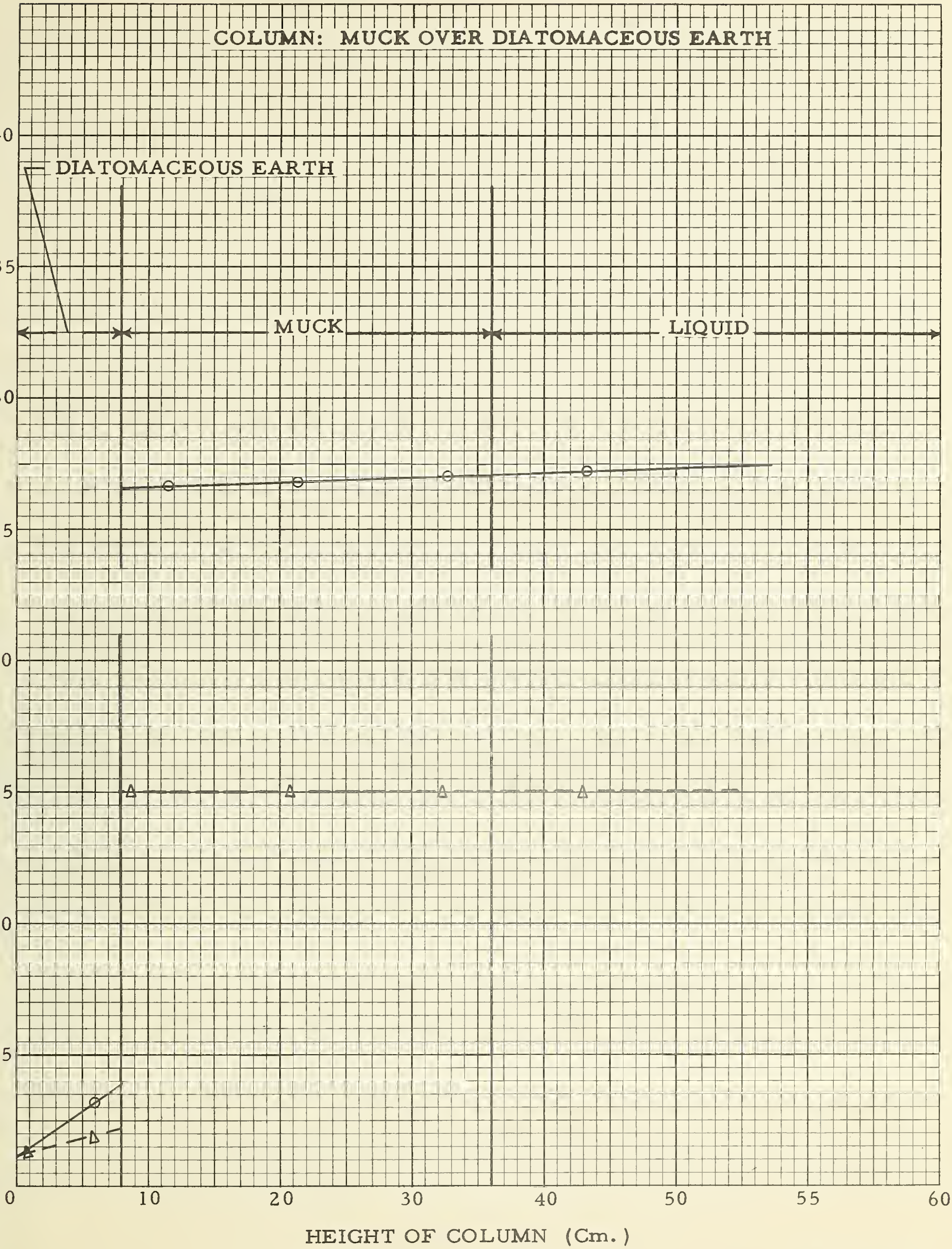
**The inorganic material in this sample was mineral soil.

Figure 1. Hydrostatic Pressures During Flow of Water Through Organic Soil Materials



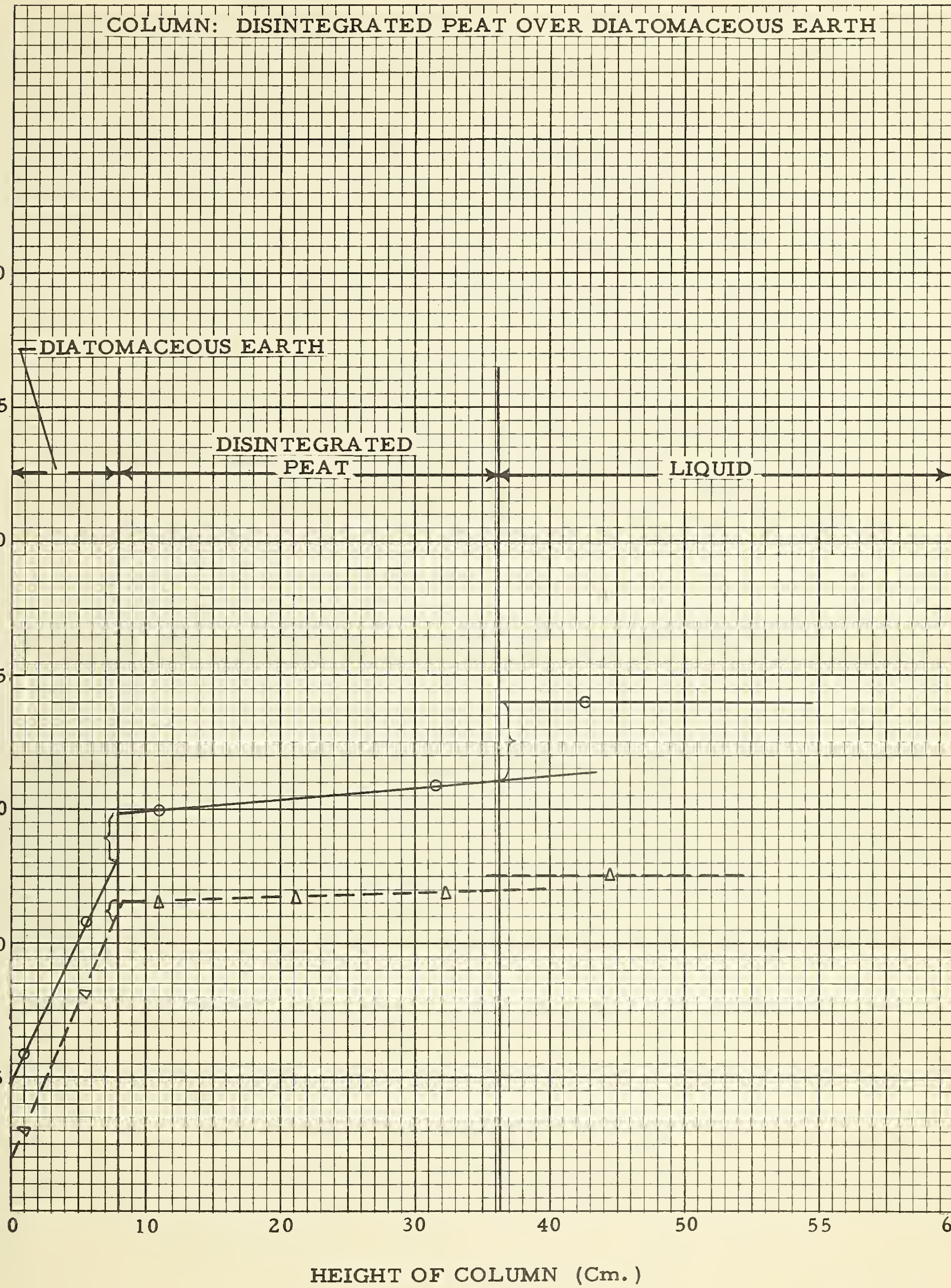
USDA-SCS-BELTSVILLE MD 1958

Figure 2. Hydrostatic Pressures During Flow of Water Through Organic Soil Materials



USDA-SCS-BELTSVILLE MD. 1958

Figure 3. Hydrostatic Pressures During Flow of Water Through Organic Soil Materials



USDA-SCS-BELTSVILLE, MD 1956

Figure 4. Color, Electrophoresis Pattern

Dr. J.E. Dawson A.F. MacKenzie March 20, 1958.

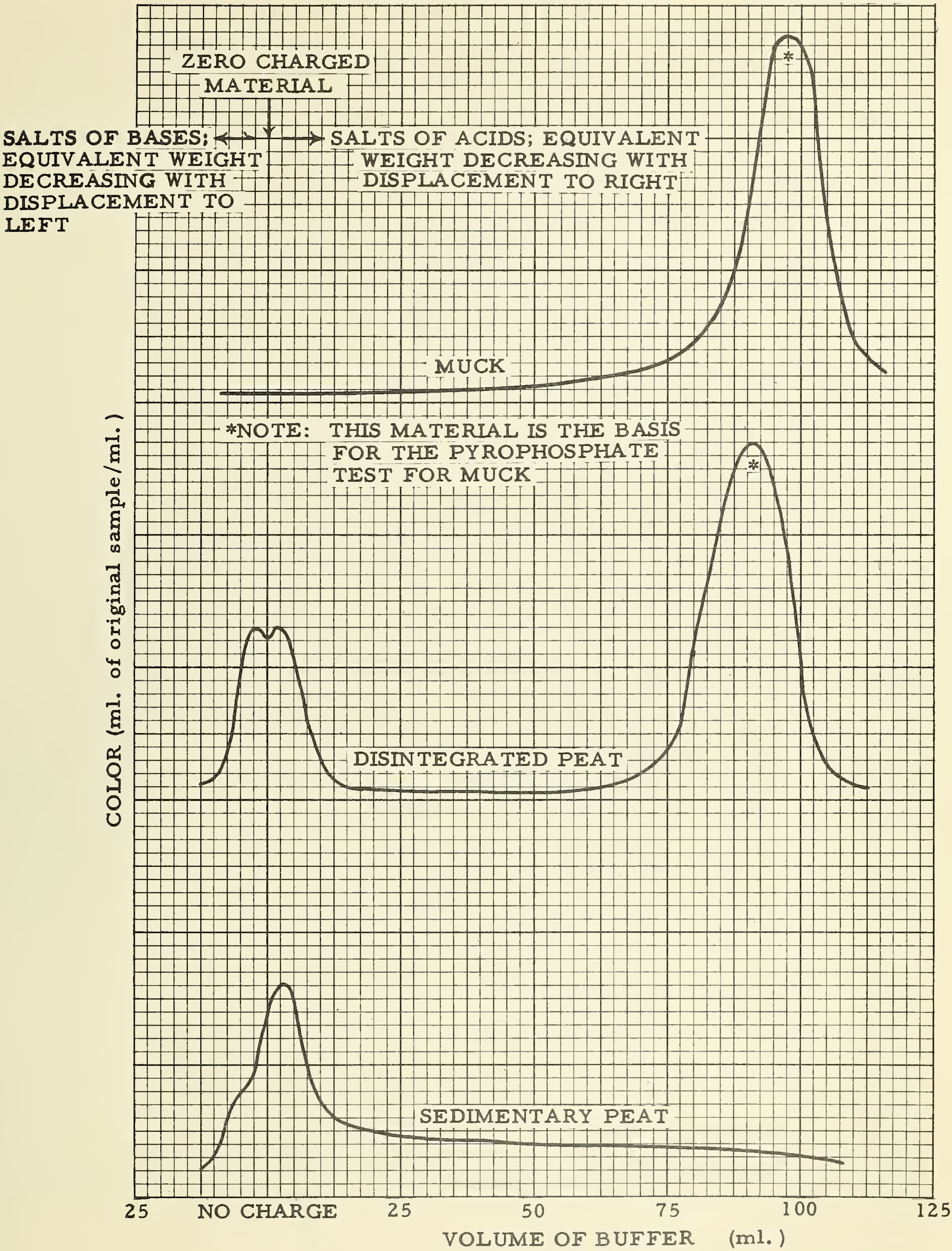
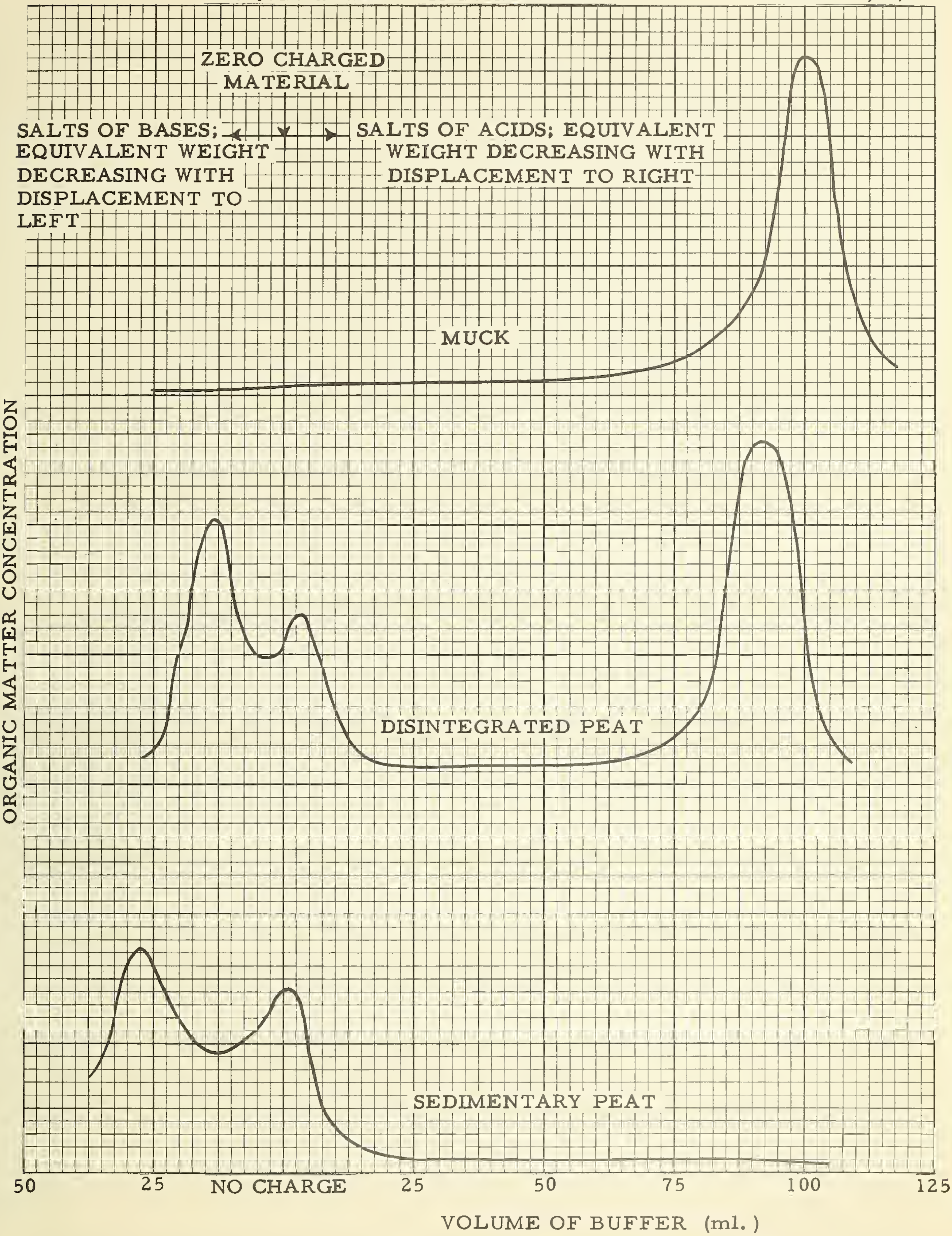


Figure 5. Organic Matter, Electrophoresis Pattern

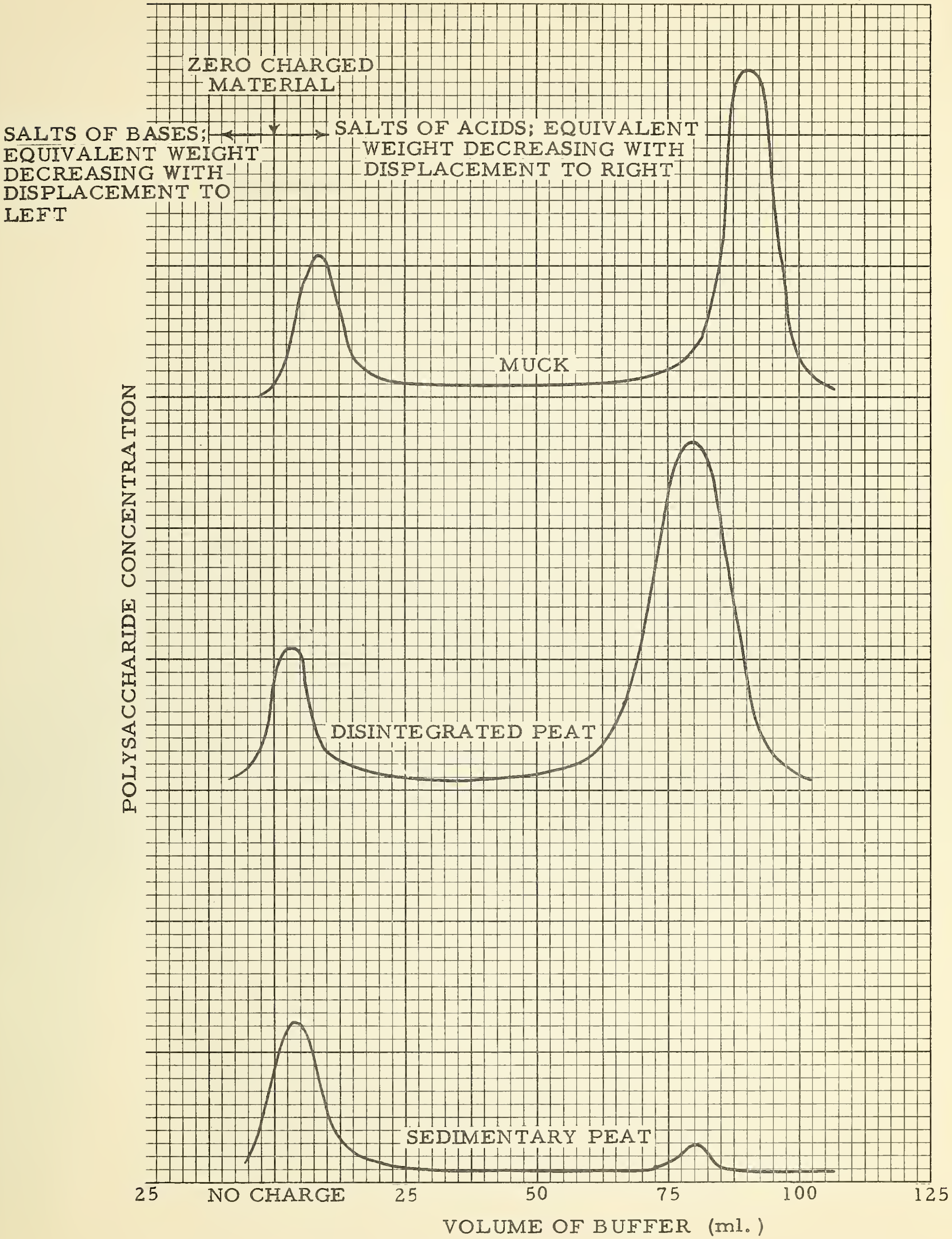
Dr. J.E. Dawson A.F. MacKenzie March 20, 1958



USDA-SCS-BELTSVILLE, MD 1958

Figure 6. Polysaccharide, Electrophoresis Pattern

Dr. J. E. Dawson A. F. MacKenzie March 20, 1958.



Master Horizons Occurring in Organic Soils

J.E. Dawson March 13, 1958

Master Horizons, Kind (I)

Horizons of type (I) are composed of dead plant materials and finely divided disintegration products from these materials. More than half of the horizon material consists of identifiable fragments of the leaves, roots, stems and wood of these plants. Three kinds of type (I) horizons occur. The particular kind is identified with two small letter subscripts. The first (left) small letter denotes the major kind of identifiable plant fragment present in the horizon. The second (right) small letter subscript denotes the next kind of horizon this one will become as it matures. The three kinds of type (I) horizons follow:

(Isd)— horizons composed of dead leaves and stems of Sphagnum moss sp., or parts thereof, mixed with parts of associated plants and finely divided disintegration products. More than half of the horizon material must be composed of leaves and stems of Sphagnum moss sp. or parts thereof. Horizons of this kind occur commonly and they will be considered Sphagnum moss peat horizons.

(Ifd)— horizons composed of dead leaves, stems and roots of marsh plants*, or parts thereof, mixed with finely divided disintegration products. More than half of the horizon material must be composed of identifiable fragments of marsh plants. Horizons of this kind occur occasionally, and they will be considered fibrous peat horizons.

(Iwd)— horizons composed of fragments of wood mixed with finely divided disintegration products. More than half of the horizon material must be composed of wood fragments. Logs are to be phased as are boulders in mineral soils. Horizons of this kind occur occasionally, and they are to be considered woody peat horizons.

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*Such plants as : sedges, Cattails, reeds, mosses other than Sphagnum, etc that commonly grow on wet soils or in shallow water.

Master Horizons, Kind (II)

More than half of the material of horizons of this type consists of finely divided secondary particles of organic matter that do not exhibit plant structures of any kind. These finely divided particles may be mixed with dead wood, roots, leaves and stems of aquatic, marsh, or swamp plants. The finely divided organic matter is of two kinds, disintegrated peat and sedimentary peat. It is chemically, with respect to the properties considered, much like the material of kind (I) horizons and it is physically much like the material of type (III) horizons. Two different horizons of kind II occur. The particular kind is identified with the first (left) small letter subscript which specifies the major kind of finely divided organic matter making up the horizon. The second (right) small letter subscript denotes the next kind of horizon this one will become as it matures. The horizon description should also indicate the identifiable fragments of plants present. The general terms used for definition of the kinds of kind (I) horizons are adequate for this purpose. The two kinds of type II horizons follow:

(IIdo) — More than half of the material of horizons of this type consists of small secondary organic particles that form nearly non-sticky and non-plastic masses when wet. This finely divided organic matter occurs mixed with dead leaves, wood, roots and stems of marsh and/or swamp plants. Horizons of this type will be considered disintegrated peat. It is not possible to determine the type (I) horizon from which a type (IId) horizon was derived. Therefore, a type (IIdo) horizon should not be considered the same as a type (Ifd) horizon. Horizons of this kind, (IIdo), occur very frequently.

(IIao) — horizons composed of sedimentary peat particles, fecal pellets, that are sometimes mixed with small amounts of detritus from plants growing on soils surrounding the bog during formation of this horizon and with parts of aquatic plants (c.f. leaf parts from potomageton), pollen grains, chitinous insect and animal parts and diatom shells. The amount of material that can be identified without altering the secondary particle structure is very small. The fecal pellets of sedimentary peat horizons form nearly non-sticky, in absence of clay, and slightly plastic masses when wet. Horizons of this kind occur quite commonly in profiles formed in depressions.

Master Horizons, Kind (III)

Horizons of kind (III) are composed of organic matter that does not change with time with respect to the defining characteristics. The organic matter may be decreased in or removed from these horizons by biological oxidation, fire or wind erosion, but it, the organic matter, always contains brown acids, or salts thereof, soluble in sodium pyrophosphate and microbial polysaccharides. Only one kind of kind (III) horizon occurs.

(IIIo) — horizons composed of muck, finely divided organic matter usually having a crumb structure and always containing both brown acids soluble in sodium pyrophosphate solution and microbial polysaccharides. Also, muck has a high content, 300 meq. per 100 grams of organic matter, of relatively strong acid groups that exchange with barium acetate to produce pure acetic acid.

All kind (III) horizons that occur below any kind of horizon that is composed of or contains peat are burried horizons in the sense that they were surface horizons above the water table for sufficient time prior to formation of the peat or peat containing horizon to allow oxidation of peat to muck.

Master Horizons, kind (IV)

Horizons of type IV are dominated by inorganic materials that were either formed by bog plants and/or animals or were incorporated into secondary structures through bog organism activities. Three kinds of inorganic materials are involved; carbonates, diatoms and mineral soil particles. These three kinds of materials may be mixed with organic materials or incorporated within coatings, of such materials of at least three kinds. Type(IV)horizons either have high color values compared to other types of organic soil horizons or develop high color values upon thorough drying. The particular kind of type (IV) horizon is identified by two small letter subscripts. The first (left) small letter denotes the kind of inorganic material that dominates the horizon. The second (right) small letter subscript denotes the kind of organic matter occurring in the horizon. The kinds of type (IV) horizons follow:

(IVma), (IVmo) — horizons composed of bog marl, a mixture of free calcium carbonate and sedimentary peat (IVma) or of muck coated calcium carbonate particles, (IVmo). The calcium carbonate equivalents of these horizons are usually in the range of 70 to 90%. It can be completely dissolved by dilute hydrochloric acid so as to leave a residue of muck or sedimentary peat. Mineral soil material, diatom shells, carbonate encrusted Chara, and/or shells of aquatic animals are commonly found in bog marl horizons. Kind (IVm) horizons either have or dry so as to have color values around 5.

(IVea), (IVeo), (IVe) — horizons composed of clumps of diatom shells either coated with or mixed with organic matter. In horizons in which the diatom clumps are coated with organic matter the coating may be either sedimentary peat, (IVea), or muck, (IVeo). These horizons dry so as to have color values around 5, and after drying to this extent they should be designated as kind (IVe) horizons.

(IVta),(IVtd), (IVto)—horizons composed of a mixture of mineral soil material and organic matter. These horizons have organic matter contents above 30% and less than 50%* except

*Organic soil samples not dominated by either marl or diatoms can be considered a mixture of mineral soil and organic matter if they contain less than 70% organic matter. A soil sample is considered organic if it contains at least 30% organic matter. The average of these two values is 50% organic matter, and this is the origin of the 50% value used above. This value has been suggested as the distinction between peat and muck by Alway. The proposal now being made is that the mixture situation be recognized, but that it be handled apart from the distinction between muck and peat.

in the case of sands which have a lower limit of 20% organic matter. The organic matter in these horizons may be <u>sedimentary</u> <u>peat</u>, (IVta); <u>disintegrated</u> <u>peat</u>, (IVtd); or muck, (IVto). The mineral matter in kind (IV) horizons may be either sand, silt or clay or mixtures of these materials. It is important that what is present be recorded in a profile description. It may not be desirable however to have a special subtype of horizom based on the mixture present.

Master Horizons, Kind (D)

D— Any non-conforming mineral substratum within or under an organic soil that is not genetically a part of the organic soil (i.e., was not either formed by bog plants and/or animals or incorporated into secondary structures through bog organism activities. Kind (D) horizons may be gleyed. When they are gleyed the subscript g should be used, c.f. (Dg).

Genetic Relations Between Organic Soil Materials
(Horizons dominated by each material are given in parentheses)

J.E. Dawson

Marsh and Swamp Plant Scheme

I. Dead Marsh Plant Materials (Peats); sedges, bulrushes, cattails, reeds, trees, shrubs, *Sphagnum* mosses, etc.:

Dead *Sphagnum* moss leaves and stems, Sphagnum Moss Peat (Isd); Dead leaves, roots and stems of marsh plants, fibrous peat (Ifd); Dead woody particles (not logs), woody peat (Iwd).

↓

Disintegration Process:

Destruction of plant structures through digestion by animals; hydrolysis by plant, animal bacterial and fungal enzymes; and by mechanical forces such as passage through digestive tracts and movement due to wind and wave action.

↓

II. Finely divided materials derived from plants and animals, and not showing plant structures of any kind; intermediate materials between (I) and (III); chemically more like (I); physically more like (III).

Disintegrated Peat (IIdo), i.e. disintegrated peat, mixed with moss, fibrous, and woody peat.

↓

Decomposition process:

Biological and chemical changes occurring mostly above the water table.

↓

III. Muck (IIIo), finely divided organic matter usually having a crumb structure and containing both soluble brown acids (and salts of same) and microbial polysaccharides. This material is represented as not changing with time with regard to the distinguishing characteristics noted in the proceding sentence. It may disappear from the system but it does not loose the above characteristics.

Aquatic Plant Scheme

I. Aquatic Plant Materials; Algae, pond weed, duckweed, diatoms, Chara, etc.:
An organic horizon of unaltered material from these plants has not been observed; Marl is formed by growth of these plants in Calcareous lakes.

Disintegration process:

Primarily digestion of above plants by aquatic animals. Process is usually quite complete. Material is believed to have been reworked several times.

II. Sedimentary Peat, (IIao), fecal pellets from disintegration process. These pellets form masses of nearly non-sticky and slightly plastic peat when wet. Fecal pellets sometimes contain clumps of diatoms or mineral soil particles. When samples of such pellets are dryed the samples are dominated by the inorganic material and the horizons are (IVea) and (IVta), respectively.

Decomposition process:

Process consists of biological changes, especially oxidative changes, occurring mostly above the water table. Process produces a residue of soluble brown acids and microbial polysaccharides.

III. Muck, (IIIo); see Marsh Plant Scheme for description. The organic matter of (IVea) and (IVta) horizons may be oxidized to muck converting these horizons to (IVeo) and (IVto), respectively.

Drying process:

When sedimentary peat or muck high in diatoms is dryed or oxidized and dryed the organic coatings shrink and expose the inorganic material. The process is not reversible. The dry samples are dominated by the inorganic material.

IV. Diatomaceous earth (IVe); All layers dominated by diatoms will be considered diatomaceous layers, c.f. (IVea), (IVeo) and (IVe).

Calcification process:

In calcareous lakes bicarbonate used in photosynthesis by submerged plants lowers the CO_2 pressure under which the water would remain at equilibrium and precipitates $CaCO_3$. In addition Chara and some algae form $CaCO_3$ solid directly.

IV. Bog marl (IVma) and (IVmo); layers of bog marl that have not been oxidized are a mixture of carbonate crystals and fecal pellets, (IVma). When the organic matter of the fecal pellets has been oxidized to muck, the soluble brown muck may occur adsorbed to the carbonate crystals; Muck and carbonate crystals are (IVmo) horizons.

Relation of Suggested Master Horizons to Basal Layers, Category V, of the 5th Approximation.

J.E. Dawson March 13, 1958

Basal Layer of 5th Approximation	Master Horizon
10.11	(Ifd)
10.12	(IIIc)* and (IVto)
10.13	(Isd)
—— basal layer of woody peat	(Iwd) and
—— basal layer of disintegrated peat	(IIdo), (IVtd)
10.21	(IVmo) and (IVma)
10.22	(IVea), (IVeo)* and (IVe)*
10.23	(IIao) and (IV_{ta})

*Burried layers of these three types occur and often can be recognized. These probably should be handled as burried layers are usually handled in mineral soil surveys.

A Summary of Genetic Relations between Master Horizons of Organic Soils[1]

J.E. Dawson

March 13, 1958.

Soil Horizon / Plant Association	*Sphagnum* Moss	Marsh Plants other than *Sphagnum* Moss	Swamp Plants	Aquatic Plants: Non Calcareous Lakes, Low Diatom	Aquatic Plants: Non Calcareous Lakes, High Diatom	Aquatic Plants: Calcareous Lakes	Aquatic Plants: Lakes in eroded watersheds
Horizons dominated by dead plant materials.	(Isd)	(Ifd)	(Iwd)	(None)	(None)	(None)	(None)
Horizons dominated by disintegrated plant materials that are especially physically different from type (I) horizon materials.	(IIdo)			(IIao)	((--))	((--))	((--))
Horizons dominated by organic materials that are especially chemically different from type (I) and (II) horizon materials.	(IIIo)				((--))	((--))	((--))
Horizons dominated by inorganic materials.					(IVea) (IVeo) (IVe)	(IVma) (IVmo)	(IVta) (IVto)

1. Parentheses indicate an horizon as a whole, double parentheses indicate organic matter of an horizom dominated by inorganic material.

Composition of Master Horizons of Organic Soils

J.E. Dawson   March 14, 1958

Organic → / Inorganic ↓	Dead plant materials	Disintegrated Peat	Muck
Variable and low	(Isd), (Ifd), (Iwd)	(IIdo), (IIao)	(IIIo)
Bog Marl		(IVma)	(IVmo)
Diatoms		(IVea)	(IVeo)
Mineral Soil		(IVta), (IVtd)	(IVto)